

# **THE MOBILITY OF TOOL AND DIE MAKERS 1940 - 1951**

**A Survey of the Work Experience,  
Training, and Personal Characteristics  
of Workers in a Critical Occupation**

**Bulletin No. 1120**

**UNITED STATES DEPARTMENT OF LABOR**

**Maurice J. Tobin, *Secretary***

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## Letter of Transmittal

United States Department of Labor,  
Bureau of Labor Statistics,  
Washington, D. C., November 14, 1952.

The Secretary of Labor:

I have the honor to transmit herewith a report on the mobility of tool and die makers. This report is the first of a series of pilot studies covering the work experience, mobility, training, and personal characteristics of workers in occupations vital in defense mobilization. It evaluates the findings of the study in terms of their significance for manpower planning in a mobilization period.

The study was financed by the Department of the Air Force. It is one of the industrial manpower research studies sponsored by the Air Force under Project SCOOP (Scientific Computation of Optimum Programs) to determine the manpower feasibility of military programs. The research findings are the exclusive responsibility of the Bureau of Labor Statistics and are not necessarily concurred in by the Air Force.

The study was conducted in the Bureau's Division of Manpower and Employment Statistics under the supervision of Richard H. Lewis. The report was prepared by Sol Swerdloff and Abraham Bluestone with the assistance of Chester F. Schimmel. The Bureau wishes to acknowledge the generous assistance and cooperation received in connection with this study from officials of other government agencies, trade associations, labor unions, and the more than 300 industrial firms from whose pay-rolls the workers interviewed were selected. The Bureau wishes to express its deep appreciation to the more than 1,700 tool and die makers who gave their time and cooperation in furnishing the essential data from which this report was prepared.

Ewan Clague, Commissioner

Hon. Maurice J. Tobin  
Secretary of Labor.



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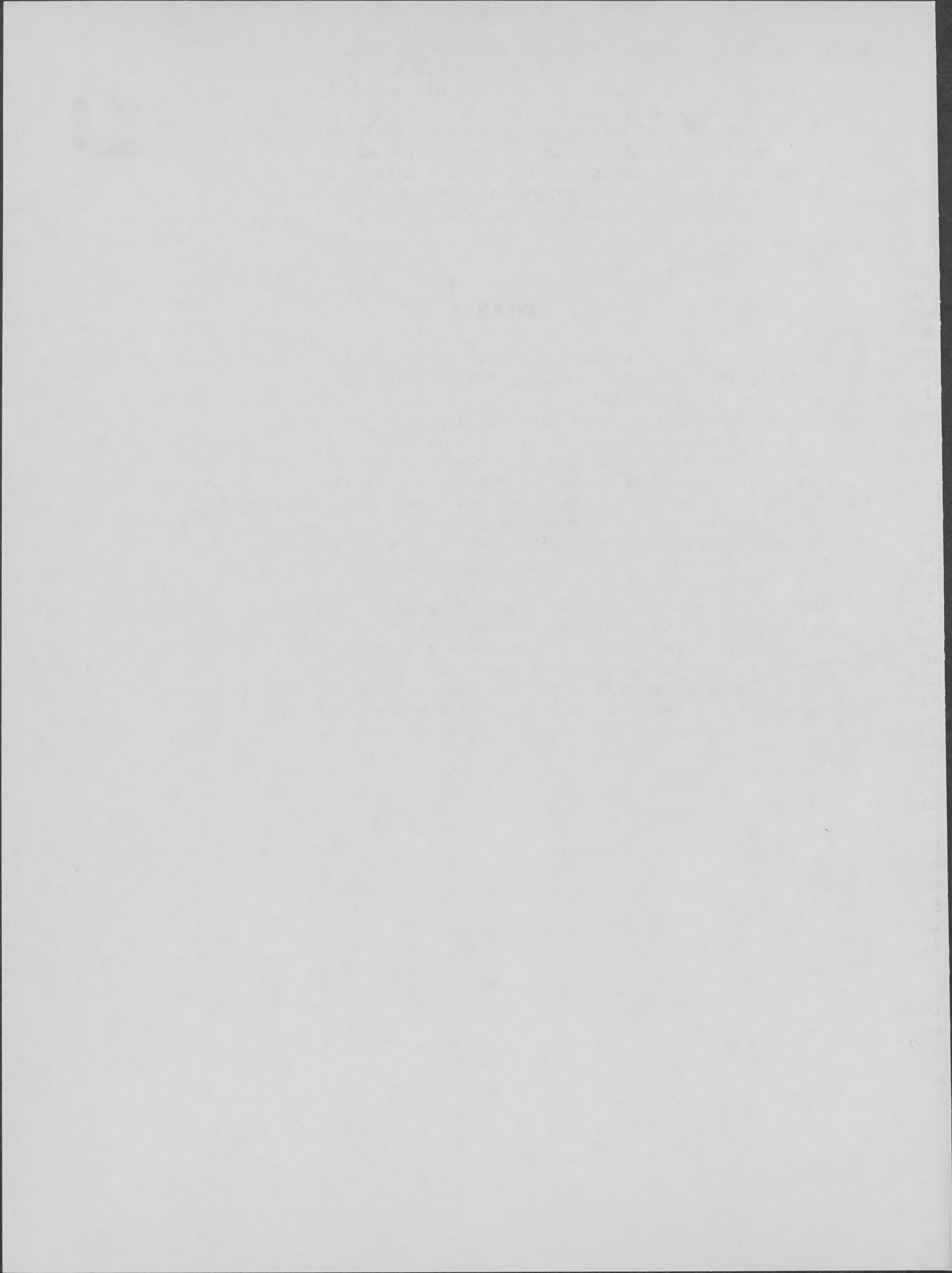
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# THE MOBILITY OF TOOL AND DIE MAKERS

## INTRODUCTION

For effective mobilization manpower planning it is essential to have a broad knowledge of the Nation's resources in critical key occupations. When related to estimates of the manpower requirements in these occupations under mobilization conditions, such information can aid in determining how many new workers must be trained and the possible sources of recruitment of these trainees. Manpower policies designed to provide for a flow of workers with scarce skills into the essential activities where they are most urgently needed should be based on knowledge of the pattern of movement of workers from job to job. Plans for setting up training programs can be guided by data on how the workers in the occupation qualified for their jobs. Possibilities of augmenting the available supply of fully qualified workers can be gaged by the extent to which workers with partial or related skills have been able to enter the occupation in the past. A thorough understanding of the nature of our resources in key technical and skilled occupations and the balancing of these requirements against the requirements for defense production and essential civilian activities are also vital in setting up policies governing Selective Service deferments or reserve call-ups of workers in these occupations.

To provide information on these and other points related to the measurement and utilization of the Nation's occupational resources, the Bureau of Labor

Statistics has undertaken a series of pilot studies covering the work experience, training, personal characteristics, and occupational, industrial, and geographic mobility of workers in occupations vital to defense mobilization. Funds have been provided by the Department of the Air Force. Another basic objective was the exploration of the problems connected with such surveys and the development of methods which can be applied to similar research on other occupations. This report presents the results of the first of these studies, the mobility of tool and die makers. Future reports will cover foundry molders and coremakers, and electronic technicians. The Bureau of Labor Statistics recently made a study of the occupational mobility of scientists, with funds provided by the Office of Naval Research 1/

The survey of work experience and training of tool and die makers was designed to provide specific answers to questions concerned with the provision of an adequate number of these workers in mobilization and the most effective utilization of the available supply. To what extent do tool and die makers move from job to job and how freely do they transfer between industries? What is the pattern of their movement from city to city and what are their reasons for making such geographic shifts in employment? Do young men make more job changes than older workers and

1/ Occupational Mobility of Scientists, (Preliminary Report), U. S. Department of Labor, Bureau of Labor Statistics, April 1952.

what kinds of changes do they make? Do single men change jobs more often than married workers? Does the kind of training the individual receives affect his willingness and ability to make job changes? How many of the tool and die makers were trained by apprenticeship? How did those without apprenticeship qualify for the trade and how long did it take them? What is the age distribution of presently employed tool and die makers and what are the probable losses due to death and retirement in the next 5 or 10 years? These questions illustrate the types of information which are provided by the survey and are presented in this report.

The present study is based primarily on the analysis of 11-year work histories (1940-51) obtained by personal interviews in the spring of 1951 with more than 1,700 tool and die makers. In addition to providing a detailed record of his work experience, each worker explained how he learned the trade, answered a number of specific questions on his personal history, and gave his opinion of the occupation. The names and addresses of tool and die makers to be interviewed were selected from the payrolls of more than 300 metalworking plants located in seven large metalworking centers. These plants were so chosen that the selection of workers would reflect as far as possible the national distribution of tool and die maker employment among industries. The selected tool and die makers were then interviewed in their homes by field representatives of the Bureau of Labor Statistics using a questionnaire form especially designed for the survey. In addition to data obtained from the individual workers, another questionnaire was filled out for each plant providing information on the personnel and training policies of the firm.

Tool and die making was selected as the first occupation to be studied because of its vital importance in a mobilization economy. Tool and die makers are highly skilled craftsmen who

make the cutting tools used on machine tools to do the actual cutting or chipping away of metal, and the jigs, fixtures, and other accessories which hold the work while it is being machined. They also make gages and other measuring devices needed for precision work. Some make dies used in forging, stamping, and pressing, and the metal molds used in die casting and plastic molding. The precision which the work demands requires a high degree of skill which is obtained by long training or experience, usually requiring four years or more. Qualified tool and die makers are at the top of the occupational ladder among skilled craftsmen, and are among the highest paid workers in the metal-working field.

The estimated 100,000 tool and die makers employed in this country in early 1952 had jobs in some 9,000 different plants in almost all metalworking industries. The largest single employer of tool and die makers was the automobile industry, accounting for more than 17 percent of all workers in this occupation. Tool and die jobbing shops, which are usually small and which make tools, dies, jigs, and fixtures, and other machine tool accessories for other companies on individual order, employ nearly as many tool and die makers as does the automobile industry. Many tool and die makers work in other machinery plants, including plants making farm machinery and tractors, machine tools, and industrial machinery and equipment. Other large groups are employed in plants making electrical machinery and equipment, and fabricated metal products, such as hardware and metal stampings. During the present mobilization period, as in World War II, the aircraft industry and Government ordnance plants are employing increasing numbers of these workers.

Geographically, the majority



of the tool and die makers are employed in the five Midwestern States of Michigan, Ohio, Indiana, Illinois, and Wisconsin. Michigan alone employs one-fourth of the Nation's tool and die

makers. Other States ranking high in the employment of these craftsmen are New York, Pennsylvania, Connecticut, New Jersey, Massachusetts, and California.

# SUMMARY OF THE FINDINGS

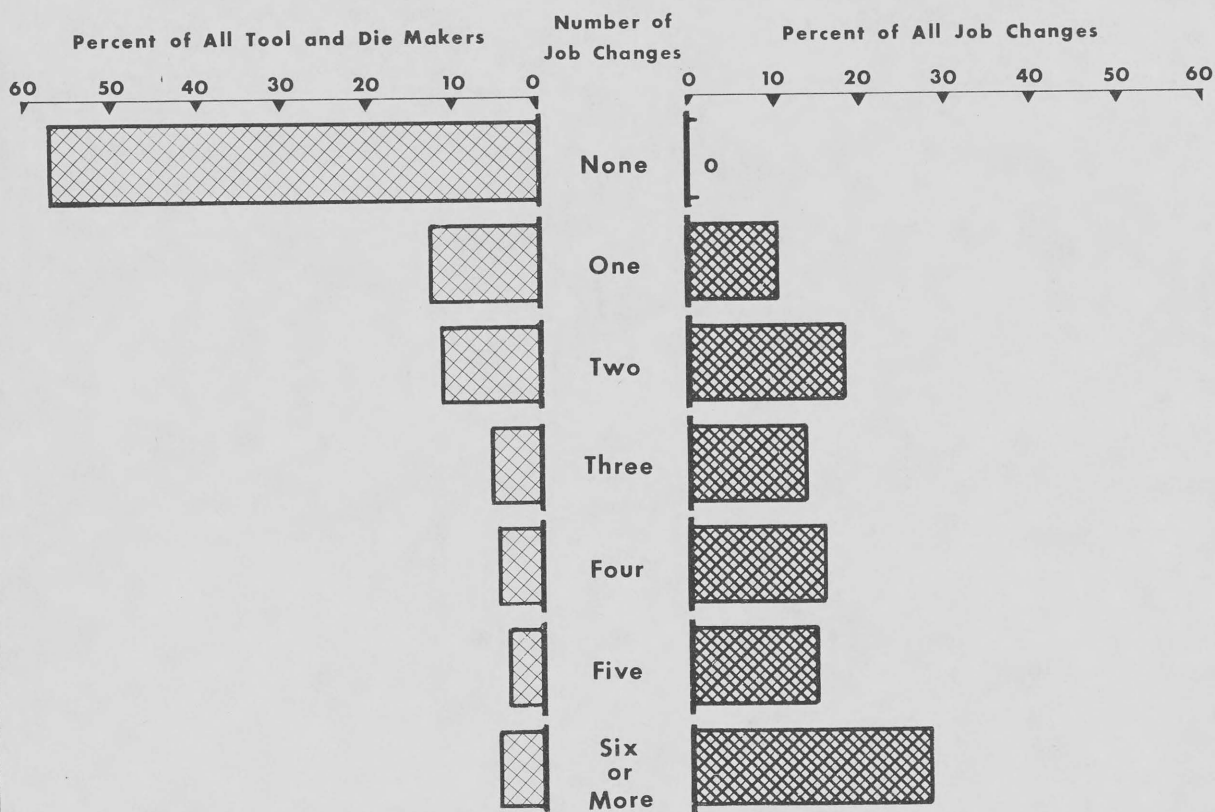
## Mobility

The analysis of the mobility of the workers included in the survey was based on their work histories during the period 1940-1951. These 11 years included successive periods of tooling-up and wartime production and of post-

war reconversion and prosperity: a time of favorable employment opportunities for tool and die makers. Interpretation of the results presented should be made with this background in mind.

**Chart 1. More Than Half the Workers Did Not Change Jobs**

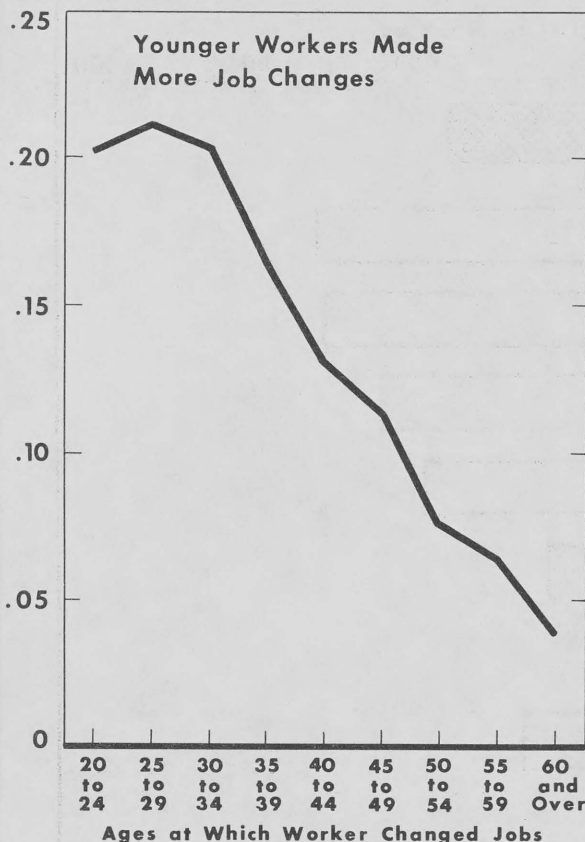
PERCENTAGE OF WORKERS  
MAKING SPECIFIED NUMBER OF EMPLOYER CHANGES, 1940-1951



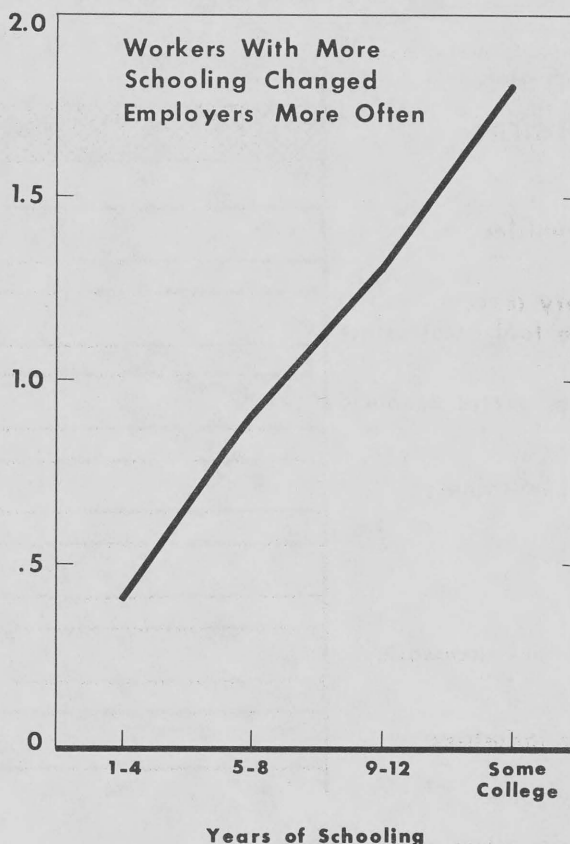
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**Chart 2. Mobility of Tool and Die Makers  
Was Affected by Age and Education**

Job Changes Per Man-Year  
Worked, 1940-1951



Average Number of Job Changes  
Made During the Period, 1940-1951



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## MOVEMENT IN AND OUT OF THE OCCUPATION

These workers did not move in or out of the occupation very frequently. During this 11-year period more than 90 percent of the men worked only as tool and die makers after qualifying in the trade. Half of those who did work in other occupations were employed in related machine shop jobs.

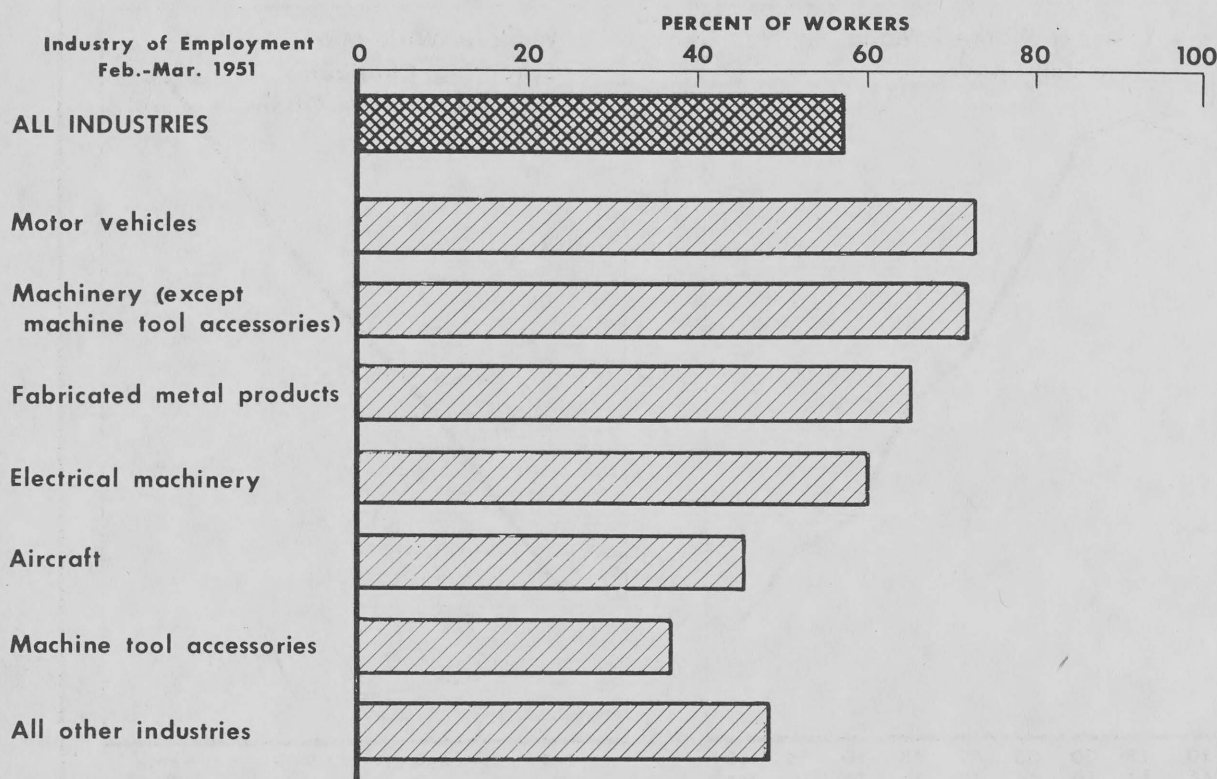
## MOVEMENT BETWEEN EMPLOYERS

Although few of the tool and die makers had worked in other occupations after qualifying in this trade, many of them had worked for more than one employer. The 733 workers who changed jobs (42.8 percent of the total in the survey) averaged nearly three employer shifts each, but among these tool and die makers there were considerable differences in the amount



### Chart 3. Automobile Workers Showed Greatest Degree of Employer Attachment

PERCENT OF TOOL AND DIE MAKERS IN SELECTED INDUSTRIES WHO DID NOT CHANGE JOBS



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of movement. More than half of them had changed jobs only once or twice. On the other hand, 229 workers changed employers four or more times, and made nearly three-fifths of all the employer shifts.

About two-thirds of the movement between employers occurred in the second half of the 11 years, a period of reconversion and postwar civilian production. Most of the increase in the amount of movement during the latter period was due to a sharp rise in the number of lay-offs. During the first half of the period, the prewar and wartime years, about one out of five of the tool and die

makers who changed jobs had been laid off; in the next 5-1/2 years the number of lay-offs had increased four times and constituted two-fifths of all job changes.

The amount of movement between employers was affected by such factors as age, education, and length of time in the labor force during this period. It also varied by the industry and city of employment. On the other hand, some other characteristics of these tool and die makers did not appear to affect their propensity to change jobs. Married workers changed employers about as readily as single workers. Tool

and die makers trained by apprenticeship and those qualifying by other methods had the same rate of movement. Likewise, the foreign-born tool and die makers shifted proportionately as much as did those born in this country.

Younger workers were more mobile than the older workers. A higher proportion had worked for two or more employers, and those who had changed jobs made many more changes. Workers changed jobs more than twice as often when they were under the age of 45 as they did after they were 45 years of age or over.

A grouping of tool and die makers by the number of months they were in the labor force in the period covered by the survey showed differences in mobility. Workers with fewer months in the labor force after qualifying as tool and die makers made proportionately more moves in relation to the length of their work experience. While age differences were an important factor, there were differences even for workers in the same age group.

There was a direct relationship between educational level and amount of job changing. Tool and die makers with the fewest years of schooling were least mobile, and the average number of changes of employer per worker increased as the educational level rose. This was not completely a result of the fact that the younger men went to school longer; even within each age group, the tool and die makers with more schooling made more job changes.

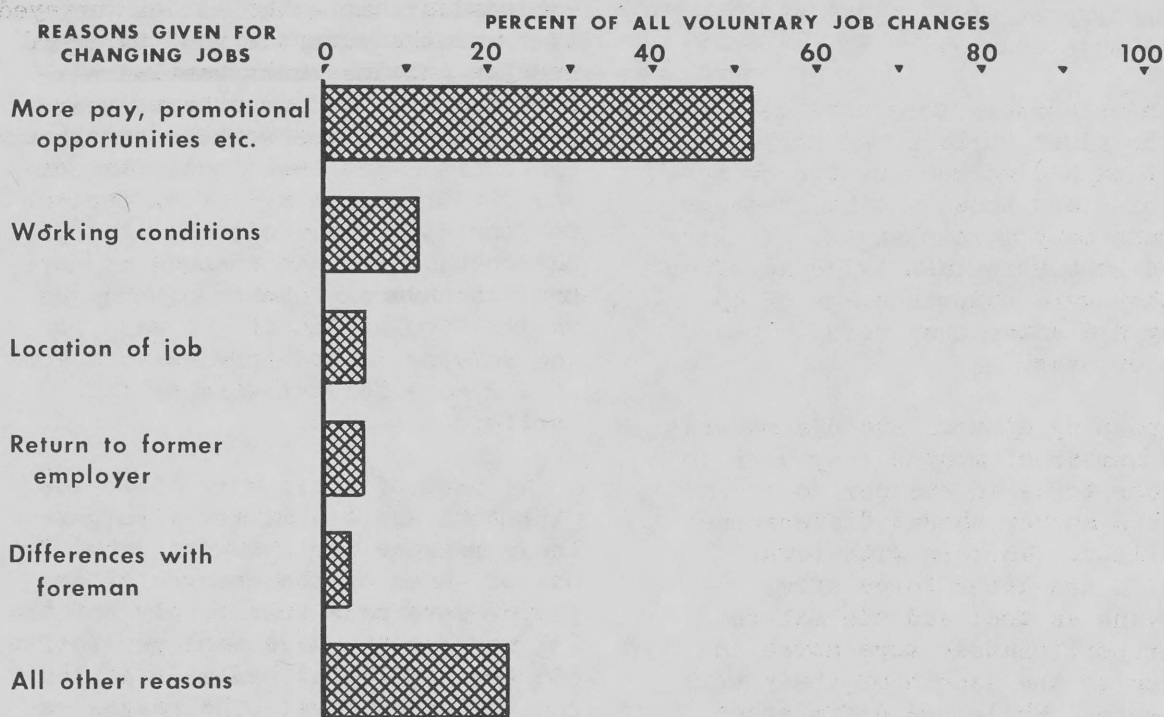
The rate of job movement varied according to the industry in which the tool and die makers were employed at the time of the survey. Relatively more workers in the aircraft and machine tool accessories industries had changed jobs than the average, whereas the motor vehicles

and machinery industries had fewer mobile workers.

The percentage of tool and die makers who had changed employers was similar among the cities surveyed with the exceptions of Hartford and Los Angeles, both wartime aircraft manufacturing centers, where more than half the workers had changed employers at least once as compared with an average of 41 percent for the other five cities. Among the workers who had changed employers, the average number of changes varied from a high of 3.6 each for the workers in Los Angeles to a low of 2.2 each for the workers in Hartford.

As part of their work histories, the tool and die makers also gave their reasons for changing jobs. Two out of three of the changes of employer were made voluntarily; of the 733 workers who made employer shifts, 605 (82.5 percent) had made at least one voluntary move. The reason reported for more than half of the voluntary shifts was to obtain better jobs, either in terms of pay or potentiality for advancement. The desire to improve working conditions or better job location prompted another large group of voluntary shifts. Most of the remainder of the changes were made for various personal reasons not apparently connected with the job. Unmarried men moved more often for better pay than did married men who appeared to have been more concerned with promotional opportunities and improved working conditions. Between workers in various age groups, there were no apparent marked differences in reasons for changing jobs, and those trained by apprenticeship and those trained otherwise gave similar reasons for changes of employer. The reasons given for job changes which also involved changes in industry were substantially the same as for all employer changes. On the other hand, personal reasons not connected with jobs were given more often than

**Chart 4. Economic Betterment Was the Main Reason Given by Tool and Die Makers for Changing Jobs, 1940-1951**



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any other reason for job changes which also involved moving from one geographic area to another.

## MOVEMENT BETWEEN INDUSTRIES

An important conclusion obtained from analysis of the work histories was that those tool and die makers who changed employers had no strong industry attachments and that they were able to cross industry lines freely. When a worker changed employers there was a better than even chance that his new employer was in a different industry. In

all, about one-third of the tool and die makers worked in more than one industry during the 11-year period covered by the survey. As was true of employer shifts, a small number of workers did the bulk of shifting between industries. It is usually assumed that a comprehensively trained worker, especially one apprentice trained, has greater ability to move from one industry to another than does one who has learned his trade without apprenticeship. The survey showed, however, that nonapprenticed tool and die makers crossed industry lines as frequently as those who were trained by that method.



## MOVEMENT BETWEEN GEOGRAPHIC AREAS

The number of tool and die makers who moved from one area to another was small; less than 9 percent of these craftsmen had changed their city <sup>2/</sup> of employment during the 11-year period. Of those who had changed cities, 86 percent had made only one or two such moves, although some workers had made as many as six. As might be expected, Los Angeles had the highest percentage of tool and die makers who had worked in other areas. Although married tool and die makers changed jobs about as frequently as single workers, they moved much less often from one geographic area to another.

### Training

Two out of three of the tool and die makers entered the trade via the apprenticeship route. The proportion of tool and die makers with apprenticeship training differed among the employing industries. More than four-fifths of those employed in the motor vehicles industry at the time of the survey had served apprenticeships as compared with only about one-third in the aircraft industry. The proportion of those trained by apprenticeship was generally the same for all age groups. One exception was in the age group that entered the labor market during the depression of the early 1930's in which group a somewhat lower percentage served apprenticeships. The apprenticeship period generally lasted 4 years, three-fifths of the tool and die makers reporting this duration of training.

About one-third of the tool and die makers in the survey had not served an apprenticeship. However, nearly half of the tool and die makers who entered this trade during the war years were not apprenticed. Most of the men who did not serve apprenticeships "picked up" the trade while working in tool rooms or machine shops, usually as machine tool operators; only about one-fifth of this group learned the trade through some more or less formal on-the-job training other than apprenticeship. In most cases, those tool and die makers not apprenticed reported a longer time to learn the trade than those who qualified through apprenticeship. <sup>3/</sup>

In the past, the United States has been able to count on immigration of workers trained in their craft in the Old World. She can no longer do this. Foreign-born tool and die makers (most of whom were trained abroad) are a diminishing source of new workers in this skilled occupation. Nearly half of the tool and die makers in the survey who were 45 years of age or older were foreign-born, but less than 10 percent of those under 45 were born in other countries.

### Personal Characteristics

The median age of the tool and die makers in the survey was 44. Less than 1 percent were below the age of 25 and about 5 percent were 65 years of age or older. About one-fourth of the workers were in each of the age groups 25-34, 35-44, and 45-54. The workers in the machine tool accessories and electrical

<sup>2/</sup> Standard Census Metropolitan Area. See p.19 for further discussion.

<sup>3/</sup> See pp. 29-30 for a discussion of qualification period for men who did not serve an apprenticeship.

machinery industries were somewhat younger than the average tool and die maker, whereas those in the motor vehicles and nonelectrical machinery industries were somewhat older.

Somewhat more than two-fifths of the tool and die makers were high school graduates and 6 percent had some academic training beyond high school. On the other hand, nearly 29 percent of these workers had eight, or fewer years of schooling. The younger tool and die makers had more schooling than the older men; the proportion finishing high school was twice as high for those under 45 as for those 45 years or older.

Relevant to the possible effect of military service calls on the members of the craft are the following facts: of all the tool and die makers interviewed, 91 percent were married; 65.9 percent had dependents other than wives, and about 17 percent were veterans of World War II.

Slightly less than a third of the workers reported that other members of their families were in the tool and die making trade. Somewhat more than 10 percent of the men interviewed reported that their fathers had been tool and die makers, and about 15 percent that their brothers worked in the occupation.

## SOME MANPOWER IMPLICATIONS OF THE STUDY

Tool and die makers are of key importance in mobilization production because they make the tools, dies, jigs, and fixtures essential to large-scale metalworking activity. They are needed in the first stages of any defense production program because of their vital importance in the task of tooling-up for volume production of aircraft, tanks, and other military items. These workers were in short supply during the tooling-up stages of World War II and there have been serious shortages of them in the current mobilization period. Tool and die making is on the Department of Labor's List of Critical Occupations. Therefore, the problems of the tool and die makers' training, recruitment, mobility, and obligations for military service are important to industry and to the responsible Government agencies.

One of the most important elements in determining the number of tool and die makers who must be trained is an estimate of the number of tool and die makers who will be needed to replace those leaving the labor force because of death or retirement. The data obtained from the survey, on the age distribution of tool and die makers, can be used to make such estimates. By applying specific death and retirement rates <sup>4/</sup> to each age group in the tool and die maker labor force, it is estimated that nearly 11,000 workers will be needed to replace those tool and die makers who can be expected to die or retire in the next 5 years. A similar

estimate for the next 10 years is 23,000 replacements. In addition to these losses, an unknown number of workers leave the occupation each year for other fields of work, thus increasing the replacement requirements.

If Selective Service deferment policies in the mobilization period are similar to those of World War II, the tool and die maker occupation will not be particularly vulnerable to losses to the Armed Forces. The age distribution of the workers in the trade is such that a relatively smaller proportion are in the age groups subject to Selective Service calls than in the male population as a whole. A very high percentage of the tool and die makers in the survey were married and most of them had dependent children. [Only about 1 percent of the workers interviewed were nonveterans, 26 years of age or younger, and without dependent children.] In addition to deferments because of age and dependency status, it is likely that many tool and die makers will receive occupational deferments because of the key importance of their work. The experience of World War II points to relatively small losses of tool and die makers to the Armed Forces.

A major aspect of manpower planning is to insure a sufficient number of workers to be trained in key occupations to meet mobilization requirements, including the expansion of employment and to provide for

<sup>4/</sup> Tables of Working Life, U. S. Department of Labor, Bureau of Labor Statistics Bulletin 1001. See Appendix C, p. 47.



replacement losses. After requirements have been balanced against the prospective supply of workers, special training programs must be set up to provide the additional skilled workers needed. Survey data on how tool and die makers qualified for the occupation can guide the establishment of effective training programs. A major finding of the study was that two-thirds of the tool and die makers qualified through apprenticeship. Training authorities agree that, in general, apprenticeship programs offer the best way of learning the trade. The survey results showed that the men who served apprenticeships learned the trade at earlier ages and they required fewer years to qualify than did those workers who qualified by other means. As a result, apprenticeship-trained tool and die makers have longer working lives in the occupation.

The expansion of apprenticeship training programs is, therefore, essential in setting up any long-range programs to provide for additional tool and die makers who will be needed in tooling up for mobilization production. Because of the long training period required for the tool and die maker apprenticeship, it is important that mobilization requirements be established well in advance and that the expansion of training activities not be delayed until full mobilization is imminent or in effect.

In addition to insuring that effective apprenticeship training programs are set up and carried through to provide for the necessary flow of workers qualifying by this means, it is also important to consider the large proportion who customarily enter the occupation without serving an apprenticeship. In past periods, a significant part of the training requirements has been met by workers entering the trade through these more informal methods, e.g., by picking up the trade through machine shop

experience. Assuming that there will be a continuous flow of workers into the occupation who have qualified by means other than apprenticeship, this will represent a substantial contribution to the meeting of mobilization requirements.

Because the informal method of qualification is important in meeting manpower requirements, more attention should be given to it and to insuring that the workers who are gradually learning the trade through this process are given maximum opportunity to improve their skills as soon as possible. This informal on-the-job training is an important source of new workers, especially when mobilization is actually under way. During World War II many employers filled their tool and die maker needs without expanding apprenticeship programs. Half the workers included in the survey who had qualified in the trade during the war years had not served apprenticeships. Some tool and die making requirements were met by upgrading partially trained men and by intensively training inexperienced workers. Men with machine shop or tool room experience, usually as machine tool operators, were the men most usually upgraded or selected for training. Instead of utilizing only fully qualified tool and die makers, many plants "broke down" the job and used available journeymen as supervisors.

Many of the men who entered tool and die making work during the war never reached the level of fully qualified tool and die makers because they were not given the opportunity to learn all parts of the job. Many were not able to hold jobs in tool and die making work after the war when the shortage of tool and die makers became less acute. They were still outside the occupation when the survey



was made in early 1951 and therefore were outside the scope of the study.

An estimate of present training levels can be derived from a special survey made by the Bureau of Labor Statistics in April 1952. It was found that there were about 9 apprentices for every 100 journeymen tool and die makers employed in the metalworking industries. Not all these apprentices will finish their training and enter the occupation. If apprenticeship training continues at these levels, the number of workers trained will not be sufficient to offset losses to the occupation. However, since it was found that about one of every three tool and die makers interviewed had not been apprenticed, consideration must also be given to workers entering the trade without such training. If this ratio continues and apprentice training remains at its present levels, the total number of new entrants to the occupation would be enough to replace the tool and die makers who leave the labor force or the occupation. However, it would not provide enough new entrants to meet present shortages and allow for future growth.

Another important implication derived from the survey is that the Nation can no longer, as in the past, count on the immigration of trained workers from other countries. Foreign-born and -trained tool and die makers are a diminishing source of new workers in this skilled occupation, and the prospective flow of immigrants under present conditions indicates that there can be no dependence on this source in the future.

One of the main problems facing manpower authorities in a mobilization period is the distribution of the available supply of experienced workers among the employing indus-

tries in such a way that the essential activities are adequately staffed by workers with the required skills. This can be accomplished, in part, by directing the movement of workers from job to job so that they move to the plants where they are most urgently needed for mobilization production.

The amount of such movement needed depends upon the way in which defense production is organized. To expand production in World War II, most metalworking plants converted their facilities to a war footing and thus were able to use their existing force of tool and die makers on defense work without any change in employer being involved. The extent to which this factor would operate in future mobilization periods depends partly upon how much of the military production will be carried on in new plants rather than in existing plants converted to war production. In the present mobilization period there has been, as yet, only a relatively limited amount of defense conversion, and much of the military output is being produced either in new plants or in reopened World War II plants.

A large proportion--more than two-fifths--of the workers did change jobs in the period covered by the survey and some changed jobs several times. It was concluded that workers were able to move freely from industry to industry. This is significant from the manpower point of view, because it means that defense plants located in metalworking centers have a potential pool of experienced workers from which they may be able to recruit additional tool and die makers. The survey also indicated workers' reasons for changing jobs. Better pay, promotional opportunities, and improved working conditions were the most frequently mentioned reasons. This

throws considerable light on the motivations and inducements which may facilitate such transfers, if desirable, for the most effective utilization of the tool and die maker labor force.

Only a limited number of workers moved from one geographic area to another in the 11-year period covered by the survey. This has several important implications for manpower planning and policy formulation. For example, the location of new defense plants in areas without concentration of metalworking plants may be affected by the problem of drawing experienced tool and die makers from other areas. Experience of the aircraft plants in Los Angeles during World War II illustrates this point. When increasing numbers of tool and die makers were needed in Los Angeles, particularly in air-

craft plants, employers were able to secure only a small percentage of qualified tool and die makers from other areas, and had to rely mainly on training their own workers as quickly as possible or on breaking down the jobs. A large proportion of the small number of workers who did make changes in location gave personal considerations, rather than factors directly connected with their jobs, as the reason for changing the city of their employment. This indicates that the inducements, such as better pay, which lead workers to move from one employer to another in the same area, were not as effective in getting workers to shift to other sections of the country. Study should be given, therefore, to the problems involved in staffing new defense plants outside of the established metalworking centers.

## DESCRIPTION AND METHODOLOGY OF THE SURVEY

The basic objectives of this study are to provide data needed for manpower planning and to develop techniques for the measurement and evaluation of mobility as it affects manpower requirements in a mobilization period. A number of other studies of mobility have been made in the last two decades, but by and large they have had different emphases and approaches. Most of these studies dealt with a cross section sample of the labor force drawn from a particular local area or a number of different localities. Thus, they included workers in a wide variety of occupations and skill levels. A few studies <sup>5/</sup> have analyzed the mobility of workers in individual occupations. In general, these studies emphasized the relationship between mobility and unemployment and reemployment. Other authors have studied mobility of workers in relation to wage theory. <sup>6/</sup> At the same time this survey of tool and die makers was being made, the United States Bureau of the Census and six university research centers began a study of mobility in six cities, <sup>7/</sup> also

under the sponsorship of the United States Department of the Air Force. The objectives of this project were similar to the objectives of this study of tool and die makers and the studies were made specifically to obtain information for manpower planning. In these surveys, samples were taken in each of the six cities of the labor force, including workers in all occupational groups. Of all the individuals included in the six-city sample, 2,578 who were skilled workers at any time during the period 1940-51 were selected and their work histories were separately analyzed. <sup>8/</sup> The results of the six-city study can be related more closely to the findings of the Bureau of Labor Statistics mobility studies than any of the other mobility studies which have been mentioned.

### SCOPE OF SURVEY

This report on the mobility of tool and die makers is based on infor-

<sup>5/</sup> For example, *The Mobility of Weavers in Three Textile Centers*, Gladys L. Palmer, *Quarterly Journal of Economics*, May 1941, vol. LV, pp. 460-487; *Ten Years of Work Experience of Philadelphia Machinists*, September 1938, and *Ten Years of Work Experience of Philadelphia Weavers and Loom Fixers*, July 1938, Work Progress Administration, National Research Project and Industrial Research Department, University of Pennsylvania.

<sup>6/</sup> For example, *the Structure of Labor Markets*, by Lloyd G. Reynolds. New York, Harper and Brothers, 1951.

<sup>7/</sup> *The Mobility of Workers in Six Cities, 1940-1949: Survey of Occupational Mobility* conducted by cooperating university research centers and the Social Science Research Council for the U. S. Department of the Air Force and the U.S. Bureau of the Census.

<sup>8/</sup> *Patterns of Mobility of Skilled Workers and Factors Affecting Their Occupational Choice, Six Cities, 1940-1951*, Industrial Relations Section, Massachusetts Institute of Technology, Cambridge, Mass., February 1, 1952.



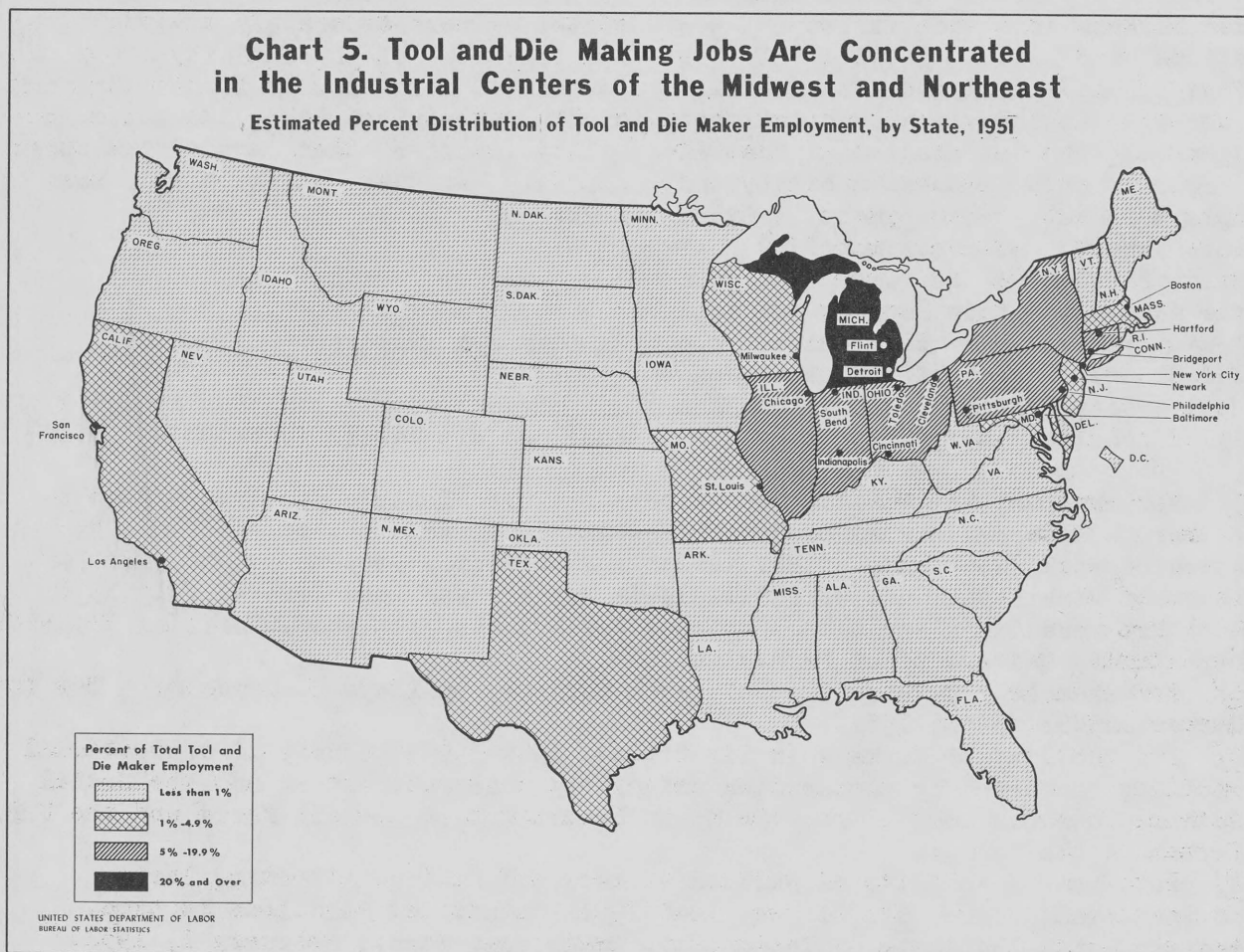
mation obtained from 1,712 journeyman tool and die makers. These workers were selected from the payrolls of 315 metalworking plants. At the time of the survey, the spring of 1951, these plants employed 13,500 of the estimated 100,000 tool and die makers in the country. For budgetary reasons, the survey was limited to a few localities. The plants in the sample were located in seven cities containing large concentrations of metalworking industries. Four of the seven were in the Midwest (Chicago, Cincinnati, Cleveland, and Detroit) where the greatest concentrations of these industries are found. To give some representation to the other regions, the remaining cities selected for study were Hartford, Philadelphia, and Los Angeles.

## THE SAMPLE

Selection of individual plants and of the sampling ratio within each plant was fixed so as to obtain a sample of tool and die makers whose industry attachment at the time of the survey would be similar to the national distribution of employment in the occupation by industry. (See Appendix tables E-1 and E-2, pp. 55 for industrial distribution of the 1,712 tool and die makers and for employment in the plants from which the sample was drawn.) The sample was not, however, designed to give a representative geographic distribution of tool and die makers or even

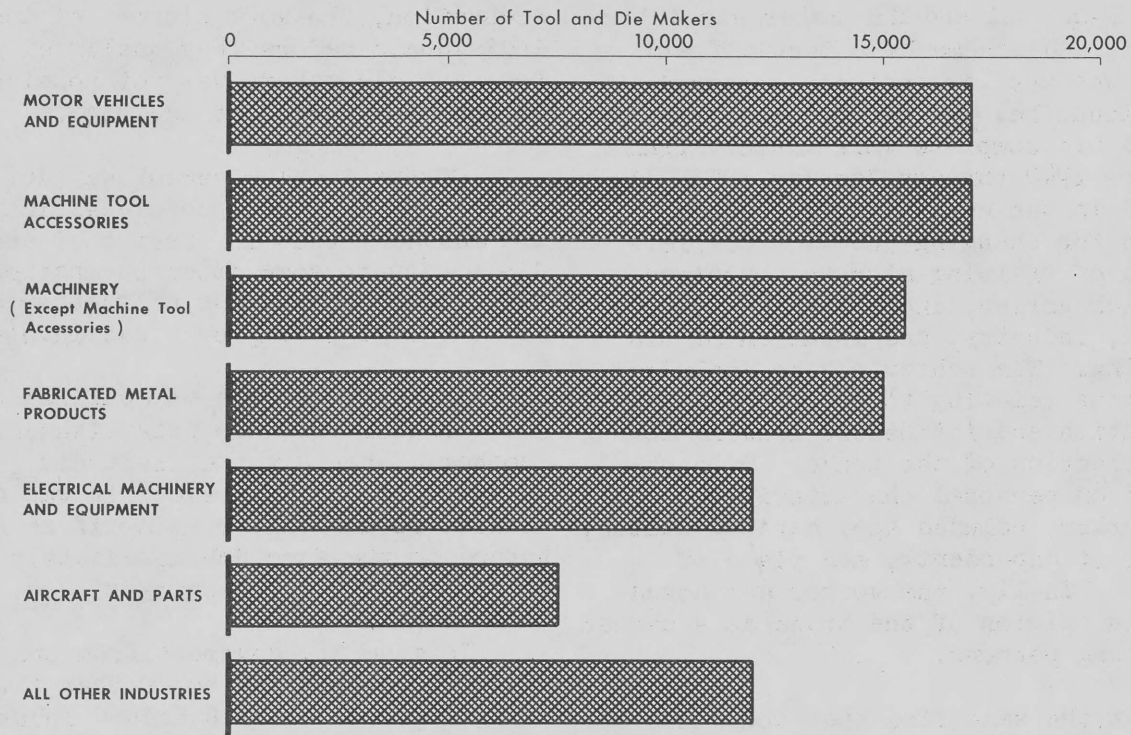
**Chart 5. Tool and Die Making Jobs Are Concentrated in the Industrial Centers of the Midwest and Northeast**

Estimated Percent Distribution of Tool and Die Maker Employment, by State, 1951





**Chart 6. Estimated Employment of Tool and Die Makers  
By Industry, 1951**



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necessarily to represent the industrial distribution of tool and die makers within the seven cities covered. All of the tool and die makers included in the survey were male. The sample was drawn from journeyman tool and die makers, including those working as foremen or leadmen. It included persons working as tool makers, die makers, combination tool and die makers, gage makers, and jig and fixture builders. Apprentices and other trainees were excluded. (See appendix A, p. 44 for the job description used in collecting the data).

The sample was selected in such a way that only qualified workers in this occupation were included. The names of tool and die makers were obtained by field agents of the Bureau of Labor Statistics from payroll records of metal-

working plants. The field agents checked the employers' job descriptions for these workers against standard job descriptions and their wage rates against the "going" wage for tool and die makers in that area. When each individual was interviewed, he gave his current job duties. This method of sample selection and screening permitted the elimination of apprentices, trainees, and other persons who were not qualified tool and die makers, but whose names might have been inadvertently obtained from the employers' payroll. It insured a more precise occupational classification than is possible in a household enumeration survey, in which the occupational classification is made on the basis of statements of individual workers or members of the household and can be verified only indirectly.

## DATA COLLECTION METHODS

Each tool and die maker was interviewed in his home by a Bureau field agent who used a specially designed questionnaire. <sup>9/</sup> Every worker reported his complete work history from January 1940 through January 1951. Included in the work history was the reason for changing jobs. A complete record of training also was obtained for each worker, including the method, length, industry, and location of his training. The schedule also included questions relating to entry into the occupation and influences leading to the selection of the trade. Data obtained on personal characteristics of the worker included age, marital status, number of dependents, and place of birth. Finally, the worker was asked for his opinion of the trade as a career for young persons.

At the same time that the names of individual workers were obtained from the employers, a special questionnaire was prepared for each of the 315 plants from which the sample was taken. This questionnaire called for data on personnel and training practices, both in 1951 and during World War II, and for facts on production methods and job organization as they affected tool and die maker employment and utilization. These data provided background information with which to evaluate and assess the training experience and work histories of the individual workers, and permitted some checks on the accuracy of worker responses.

## DEFINITIONS (See also

### Appendix A)

Four types of mobility were measured in this study: movement in and out of tool and die making, shifts

from employer to employer, job changes from industry to industry, and movement from one geographical area to another. Because this was a study of one skilled occupation, the work history of the individuals before they qualified as tool and die makers was not considered in the measurement of mobility.

Occupational movement was defined as a shift from one job classification to another; that is, from tool and die making to some other occupation or vice versa, regardless of whether or not a change of employer was involved.

Employer changes were defined as a job transfer from one establishment to another. When a worker left his job to enter military service, it was not considered a change or move if he returned to the same job immediately after his military service.

In general, movement from one broad industry group to another (i.e., 2-digit group in the Standard Industrial Classification system) was considered an industry shift. There were exceptions to this, however. The machine tool accessories industry was considered separate from the machinery industry group because the tool and die jobbing shops, which form a major part of the machine tool accessories industry, employ many tool and die makers and have a somewhat different method of operation. Similarly, the aircraft and the automobile industries were considered separate from the remainder of the transportation equipment group. A tabulation of job changes involving changes in industry using a 4-digit SIC system breakdown was made to determine whether any great amount of inter-industry movement had been eliminated by the broad classification explained above. It was found that the 4-digit system resulted in a gain of only a few percent in the number of industry changes made. It was felt that this small gain in detail did not justify the unwieldy number of indus-

<sup>9/</sup> See Appendix D, pp. 48-51 for a copy of the questionnaire form.

tries it would have been necessary to deal with.

Geographic moves were defined as change of employment from one city (standard census metropolitan area) to another. Bureau of the Census standard metropolitan areas were selected because it was believed that they correspond roughly to the local labor markets, the area within which it is customary for workers to commute to plants located in the central city or its suburbs.

## MEASURING MOBILITY

The mobility of the workers in the survey was measured in two ways: the proportion of the men interviewed who made any moves, and the average number of job changes made per worker. The interpretation of worker mobility, however, requires a more precise frame of reference than is obtained by these standards alone. Rate of movement must be measured against potential for movement; that is, the number of moves as related to exposure to the labor force during the period of the survey. Thus, three job changes made by a worker who was in the labor force the entire 11-year period would show much less mobility than three job changes for a person who was in the labor force only two years. 10/

In relating age to mobility two measurements were used. First, the workers were grouped by their ages at the time of the survey and differences were observed in the average number of job changes per person for each group. It was felt that this technique was inadequate. Inasmuch as this survey covered an 11-year period, a grouping by ages attained in 1951 indicated the experience of each age group over that time span but did not describe

the mobility behavior characteristic of particular ages, nor did it recognize that certain "ages" were not in the labor force as many years as others. A second technique was therefore devised. This consisted of grouping the job movements, not by the age of each worker in 1951, but by the ages at which the moves were made. It was thus determined that more movement occurred at some ages than at others. To allow for the unequal representation of ages in the labor force during the 11 years, the number of job moves made at each age was related to the number of years worked at that age. Thus, the mobility behavior of workers at specified ages, with potential for movement considered was obtained. 11/

Manpower planning requires information not only on the amount of movement and factors affecting it, but also on the range of movement. It is important to determine in what other occupations, industries, and areas the individuals had worked before the jobs they held at the time of the survey, and whether there was any pattern of movement. For example, did tool and die makers move only between particular industries or were they able to move freely between industries? This was determined by comparing the worker's location or industry at the time of the survey with other areas and industries in which he worked or received training.

Essential in a study of mobility which is primarily concerned with obtaining information for manpower planning is a consideration of worker motivation for changing jobs. Inasmuch as manpower policy in past mobilization periods has been predicated on the absence of compulsory manpower controls, getting workers to the most necessary jobs can be done only by offering inducements to workers to change jobs. Thus, on the questionnaire, each tool and die maker was asked to give his

10/ For explanation, see Appendix A, p. 44.

11/ For explanation, see Appendix A, p. 45.



reason for changing jobs (see questionnaire, question 20, appendix D, p. 50).

## CLASSIFYING REASONS FOR CHANGING JOBS

The reasons given by the tool and die makers were divided into two broad groups: job changes made as a result of the worker's individual choice (voluntary shifts), and job changes made as a result of factors over which the worker had no control (involuntary shifts). There were two principal groups of involuntary reasons: loss of job due to lay-off because of lack of work, shut-down of the firm, etc; and loss of job due to discharge because of unsatisfactory work performance or for disciplinary reasons. The few cases where workers reported they left their jobs because their health did not permit them to remain in their positions were also included in the group of involuntary reasons.

Reasons given for changing jobs voluntarily were classified according to the worker's motivation. One classification was "better pay." This group included job changes to obtain higher base wage rates and those made to obtain higher take-home pay because of longer workweek. Many workers moved from one employer to another to get "better jobs." This term included moves made to gain experience, promotion, or the opportunity for promotion. The first two categories are closely related, because promotion may include a raise in pay. "Working conditions" was the third principal group of reasons for shifting. Under this heading were placed job changes which were made because of the physical surroundings of the job (lighting, ventilation,

safety devices, kind of equipment in the plant, etc.), or because of objectionable or undesirable hours of employment. (A number of persons moved because they wanted to work on different shifts.) Another category was "location of the job" which included job changes made because the plant was too far from home or because of transportation difficulties. A number of tool and die makers reported "differences with foremen" as their reason for changing jobs. The miscellaneous group, "other reasons," included all vague replies such as "fed up," "just quit," "wanted a change," "tired of working there," as well as a variety of other specific explanations too scattered to be classified separately. These included such reasons as "wanted to enter defense work," "to visit friends in Chicago," "to help in family business," and others.

## LIMITATIONS OF DATA

One of the problems in studies based on interviews is the accuracy of responses made by individuals. Research on the reliability of worker response indicates that work histories obtained by personal interview are, by and large, reliable. <sup>12/</sup> In addition, the questionnaire used in this survey afforded the opportunity to make some internal checks of consistency of the workers' answers. For instance, the date of birth and the year in which schooling was completed were checked against the year of first job. Answers given to the questions on training were compared with the information reported for the work history.

An indirect check on the repre-

<sup>12/</sup> See, for example, the Reliability of Response in Labor Market Inquiries, by Gladys L. Palmer. Technical Paper No. 22. U. S. Bureau of the Budget, Division of Statistical Standards, July 1942; and Validity of Work Histories Obtained by Interviews, by Elizabeth Keating and C. Harold Stone. Industrial Relations Center, University of Minnesota.



sentative nature of the sample was made by comparing the age distribution of the sample with information obtained from the employer questionnaire (see appendix D, pp. 52-54 for copy of questionnaire). The 315 metalworking plants reported the number of tool and die makers they employed who were 55 years of age or older. The proportion of the sample 55 years or older and the proportion of the 13,500 tool and die makers as reported by the employees were similar.

The tabulations on which the findings were based were tested for statistical significance. <sup>13/</sup> Although the sample of 1,712 tool and die makers represents one of the largest numbers of workers in a single occupation ever studied so intensively and consequently offers an opportunity for detailed analysis, some of the tabulations resulted in very small groupings. No conclusions were based on cells where the number of workers was very small <sup>14/</sup> even though the differences may have appeared to be statistically significant.

Aside from the statistical limitations of the data, it should be noted that the conclusions offered are restricted in their significance because the survey covered only tool and die makers employed in this occupation at the time of the survey. Those tool and die makers working outside the occupation for any reason and those unemployed or temporarily out of the labor force could not have been included in the sample. If the work experience or personal characteristics of these workers should be significantly different from those tool and die makers in the survey, then their exclusion may alter the conclusions of the survey. However, it is unlikely that any great number of fully qualified tool and die makers who might be expected to return to the

trade were working in other occupations in February-March 1951. Tool and die makers had been in short supply for the entire period following the outbreak of Korean hostilities. Employers had been intensively recruiting these skilled workers, and newspapers in metalworking centers carried large "help wanted" ads for these workers. The United States Employment Service reported about 1,000 clearance orders in March 1951. Any journeyman, who in 1950-51 was working at a lower-skilled occupation in the metalworking field or who was working outside the metalworking trades, could easily have obtained a tool and die making job. It would seem, therefore, that those men who, in early 1951, were still not in tool and die making had either left the occupation permanently for other work or were not able to meet the requirements of employers, even though these requirements had already been lowered because of the shortage of skilled workers. This was probably the case with some men who had had experience in the occupation during the war when jobs were broken down. Although persistent shortages of qualified workers may eventually lead employers to hire and retrain some of these men, it does not seem justified at the present time to consider them members of this skilled occupation. In addition, there is no reason to believe that any great number of experienced tool and die makers who had advanced to higher rated jobs (such as tool designer) would return to the trade in the future. It should also be noted that the definition of the occupation used in this study included workers in the lower supervisory levels--leadmen and foremen. When the above circumstances are considered, it seems certain that few tool and die makers were missed because of the sampling methods used in the survey.

<sup>13/</sup> Chi-square test of significance. See appendix B, p. 46.

<sup>14/</sup> In general, a lower limit of 50 cases in a cell was set.

## FINDINGS

### The Work of the Tool and Die Makers

The tool and die maker makes tools, dies, jigs, and fixtures by machining the metal with various machine tools and by using hand tools and measuring instruments. The "all-round man" is able to plan and carry through all operations concerned with turning out a finished product. He must have a sound knowledge of the working properties of metals. He works from blueprints, rough sketches, or even oral instructions. In some plants tool and die makers do some of the actual tool or die designing.

In the making of a product, the tool and die maker plans the sequence of the cutting and finishing opera-

tions. He sets up and operates the various machine tools needed in the machining operations and selects the appropriate cutting tools. After the machining operations, he chips, files, and shapes the surfaces of the machined parts by hand, finishing them to very close tolerances, and fits and assembles the finished parts. He inspects and checks the work for conformity with original specifications and, whenever necessary, makes alterations. Tool and die making is precision work. Persons in this trade must have a great deal of mechanical ability and a liking for painstaking work. No great physical strength, however, is needed.

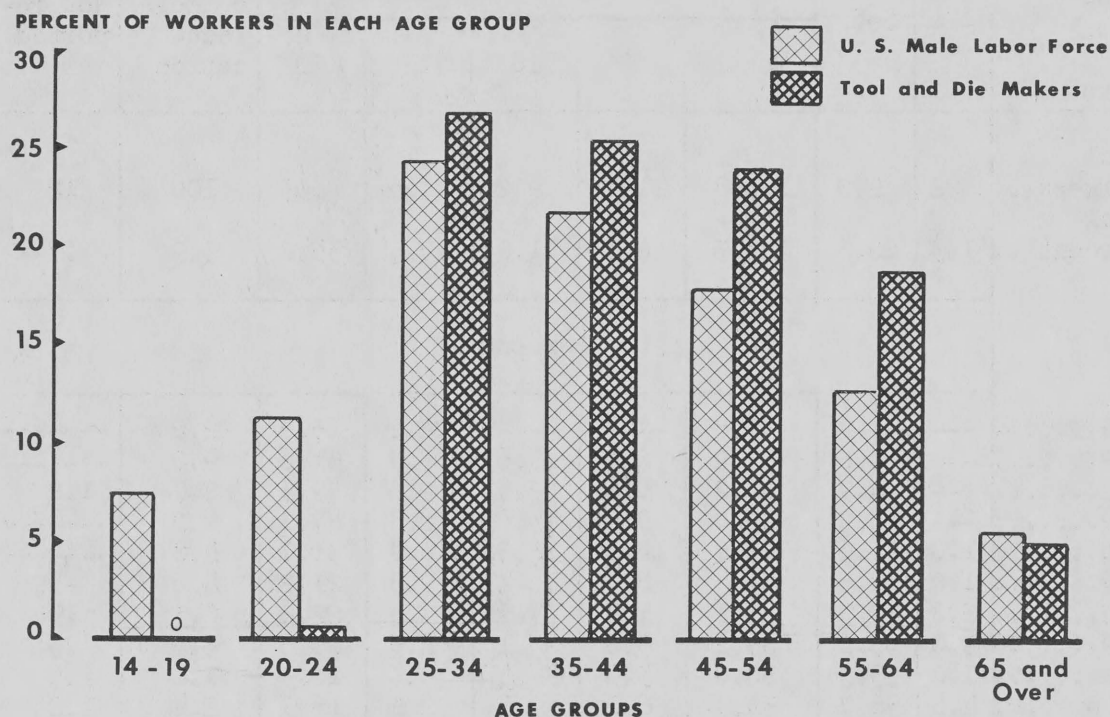
### Personal Characteristics

Tool and die makers are somewhat older than the male civilian labor force as a whole. (Chart 7) The median age of the tool and die makers interviewed was 44. This is about the same median age as for all craftsmen, foremen, and kindred workers in the six-city mobility study. <sup>15/</sup> Because this occupation requires a long training period and because many of the workers who have entered the occupation in the last few years were veterans and therefore older than the usual apprentices, only a small number of tool and die makers were below the age of 25 (less than 1 percent).

Slightly less than 20 percent were between the ages of 55 and 64, and about 5 percent were 65 years or older. About one-quarter of the workers were in each of the age groups 25-34, 35-44, and 45-54. Six persons who were 70 years or older were included in the survey. The machine tool accessories and electrical machinery industries were found to have somewhat younger than average tool and die makers, whereas those employed in the motor vehicles and nonelectrical machinery industries were somewhat older (Table E-3).

<sup>15/</sup> The Mobility of Workers in Six Cities, op. cit., p. 8.

**Chart 7. Tool and Die Makers Are an Older Group  
Than the Male Labor Force as a Whole**



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Source: Information on U. S. male labor force  
from U. S. Bureau of the Census.

About nine-tenths of the tool and die makers were married and 7 out of 10 had dependents other than their wives (table E-4). The percent of tool and die makers who were veterans was considerably smaller than of all males in the United States. Of these workers, 17.4 percent reported themselves as veterans of World War II, compared with about one-third of the employed male persons in the United States who are veterans. Not only was the percentage of the workers in the survey who served in the armed forces small, but half of them became tool and die makers after they returned from military service.

There was a wide range of educational attainment among these workers. About two-fifths of them had completed high school (table 1). Six percent had some additional academic training beyond high school, whereas a total of about 29 percent of all the tool and die makers in the survey had eight or fewer years of schooling. The younger workers had more schooling than the older men. The percentage of tool and makers who had completed high school was twice as high for those under 45 as for those 45 years or older. There were no important differences in the educational background of those tool and die makers who had served apprenticeships and those who had not (table E-5).



Table 1.—Educational Level of tool and die makers, by age, February–March 1951

Age group	Highest school grade completed								Total edu- cation not re- ported
	1-4	5-8	9th through 12th					Some college edu- cation	
			Total	9	10	11	12		
Total workers...	22	490	1,088	117	202	166	603	100	12
Total percent...	1.3	28.6	63.5	6.8	11.8	9.7	35.2	5.9	.7
	Percent								
20 - 24.....	---	---	77.8	---	---	22.2	55.6	22.2	-----
25 - 29.....	---	3.8	87.2	6.1	13.6	15.9	51.6	9.0	-----
30 - 34.....	---	4.9	86.2	4.6	9.5	12.6	59.5	7.7	1.2
35 - 39.....	---	8.8	82.0	8.4	13.6	12.8	47.2	9.2	-----
40 - 44.....	1.0	20.6	73.6	12.5	18.5	10.9	31.7	4.8	-----
45 - 49.....	1.0	38.5	55.4	8.3	16.1	9.8	21.2	4.6	.5
50 - 54.....	2.8	50.9	43.1	5.6	7.9	7.4	22.2	2.3	.9
55 - 59.....	3.0	55.8	35.2	5.0	10.1	4.5	15.6	5.5	.5
60 - 64.....	1.6	55.5	38.8	5.8	7.4	3.3	22.3	1.6	2.5
65 and over...	4.8	56.7	34.9	6.0	9.6	2.4	16.9	2.4	1.2

### Factors Affecting Occupational Choice

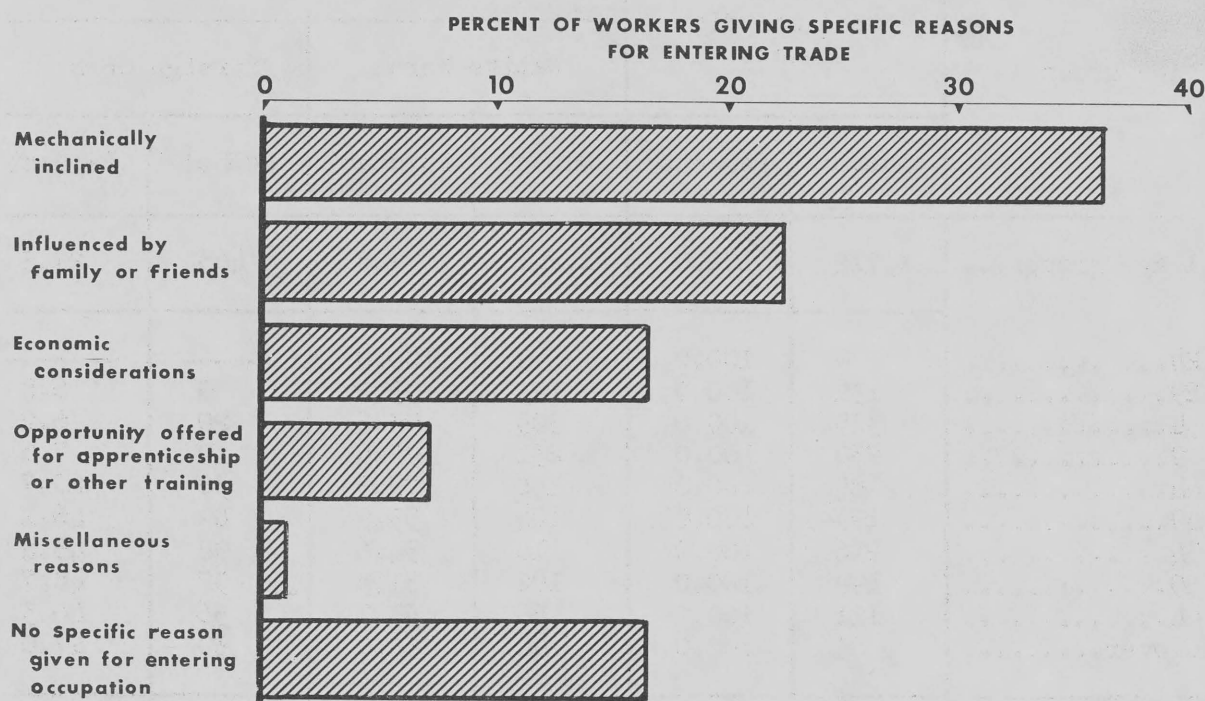
Each worker was asked to identify the influences leading him to this occupation. About three-quarters of them explained fairly definitely why they entered the trade. (Chart 8). The answers given by the remaining workers indicated that they had just drifted into tool and die making. Of the 1,287 who could give definite reasons, 621 said they became tool and die makers because they were mechanically inclined and had looked for an occupation in which they could use their aptitudes. Three hundred and eighty-four reported entering the occupation because of the advice or example of their families or friends—"My father wanted me to learn the trade and got me into the apprenticeship program." "This trade has always been in my family so I took it up, too."

About 70 percent of those whose fathers were in metalworking trades reported that members of their families had influenced them to enter this occupation. Two hundred and eighty-two reported entering the trade because they expected it to provide them a good income at once or in the immediate future-- "I started off doing machinist work but after a while I saw I couldn't make much more." The influences which led tool and die makers to enter the trade did not seem to be connected in any definite way to age or educational level.

One-third of the tool and die makers reported other members of their family in the trade. Somewhat more than 10 percent of the workers reported that their fathers were tool and die makers and about 15 percent reported that their brothers were tool



### Chart 8. Why Workers Entered Tool and Die Making



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and die makers (table E-8). Many had fathers and brothers or fathers and other relatives in the trade. The proportion whose fathers also were in the trade or in related metalworking occupations was highest for the tool and die makers in the youngest age groups. Somewhat more than one-fourth of the tool and die makers under 45 years of age had fathers whose usual or longest job was either tool and die maker, machinist, or maintenance mechanic. Only about one-sixth of the tool and die makers 45 years of age or older had fathers who worked in these occupations. This finding is not unexpected because all the metalworking trades experienced rapid growth since the turn of the century.

More than half the tool and die makers began their working lives in the metalworking field. About two-fifths of the workers who had not served apprenticeships began their working careers in metalworking jobs, most of them as machine tool operators. On the other hand, more than two-thirds of the 1,135 tool and die makers who had served apprenticeships, had started their working lives in the metalworking field. Five hundred and ninety-nine of the workers reported that after leaving school, their first job was that of an apprentice. Tool and die makers whose fathers' usual or longest job was in metalworking had more often started their working lives in metalworking occupations than had those whose fathers worked in other fields.

Table 2.--Nativity of tool and die makers, by age, February-March 1951

Age group	Total tool and die makers		Nativity			
			Native born		Foreign born	
	Number	Percent	Number	Percent	Number	Percent
All age groups...	1,712	100.0	1,247	72.8	465	27.2
20 - 24.....	9	100.0	9	100.0	-----	-----
25 - 29.....	132	100.0	123	93.2	9	6.8
30 - 34.....	325	100.0	305	93.8	20	6.2
35 - 39.....	250	100.0	231	92.4	19	7.6
40 - 44.....	184	100.0	146	79.3	38	20.7
45 - 49.....	193	100.0	104	53.9	89	46.1
50 - 54.....	216	100.0	118	54.6	98	45.4
55 - 59.....	199	100.0	102	51.3	97	48.7
60 - 64.....	121	100.0	65	53.7	56	46.3
65 and over.....	83	100.0	44	53.0	39	47.0

More than one-fourth of the tool and die makers were foreign-born. Foreign-born tool and die makers, many of whom were trained in their native country, are a diminishing source of new workers in this skilled occupation (table 2). Nearly half the tool and die makers who were 45 years of age or older were born outside this country, whereas less than 10 percent of those under 45 were foreign-born. The proportion of foreign-born tool and die makers differed among the industries and cities of employment. Detroit had the highest proportion, with 36.3 percent of them having been born out-

side the United States; Chicago followed with 30.4 percent (table E-6). The lowest percentages were in Hartford and Los Angeles where less than one-sixth of each city's total were born abroad. The distribution of foreign-born tool and die makers by industry followed the city pattern, with the highest proportion in the motor vehicles and machine tool accessories industries, both of which are concentrated in Detroit (table E-7); and the lowest proportion in the aircraft industry, which in this study was represented by tool and die makers in Los Angeles and Hartford.

About one-sixth of all the tool and die makers were raised on farms. As can be expected from the general shift of the United States population to the cities, the proportion of tool and die makers with farm backgrounds has been decreasing. Of the tool and die makers under 45, about 11 percent were raised on farms, whereas the per-

centage for those 45 years of age or older was twice as high. Because the importance of foreign-born tool and die makers is also decreasing, it appears that the supply of new workers to this occupation in recent years has been coming principally from the cities and towns of the United States.

## Training

The principal way in which tool and die makers have learned the trade has been through apprenticeship. An apprentice is a worker who learns, according to a written or oral agreement, a recognized skilled trade requiring two or more years of work experience on the job through employment, supplemented by appropriate related trade instruction.

About two-thirds of the men interviewed (1,135) had served apprenticeships, and 577 had become qualified tool and die makers by other means. The proportion of workers trained by apprenticeships varied by industry (chart 9). More than four-fifths of the tool and die makers who were working in the motor vehicles industry at the time of the survey had been apprentices. The lowest proportion trained by apprenticeships was in the aircraft industry, in which only one-third (33.8%) of the tool and die makers had been apprenticed. This is partially explained by the rapid growth of the industry and by its location away from other metalworking centers. Much the same picture appears when the tool and die makers are grouped by the industry in which they first qualified for their craft. Again the motor vehicles industry was highest and the aircraft industry lowest (chart 10). Almost 85 percent of the workers who qualified for the trade while employed in the motor vehicles industry had served apprenticeships, as compared with less than 25 percent of the workers who had

learned the trade in the aircraft industry.

The proportion of those trained through apprenticeship was the same for the various age groups. An exception was the age group 35-50 in which the proportion who had served apprenticeships was lower. In all probability, this exception was due to the relatively little training offered during the depression years when these men entered the labor market. They were able to get into the trade during the war years, when there was greater opportunity to enter through means other than apprenticeship.

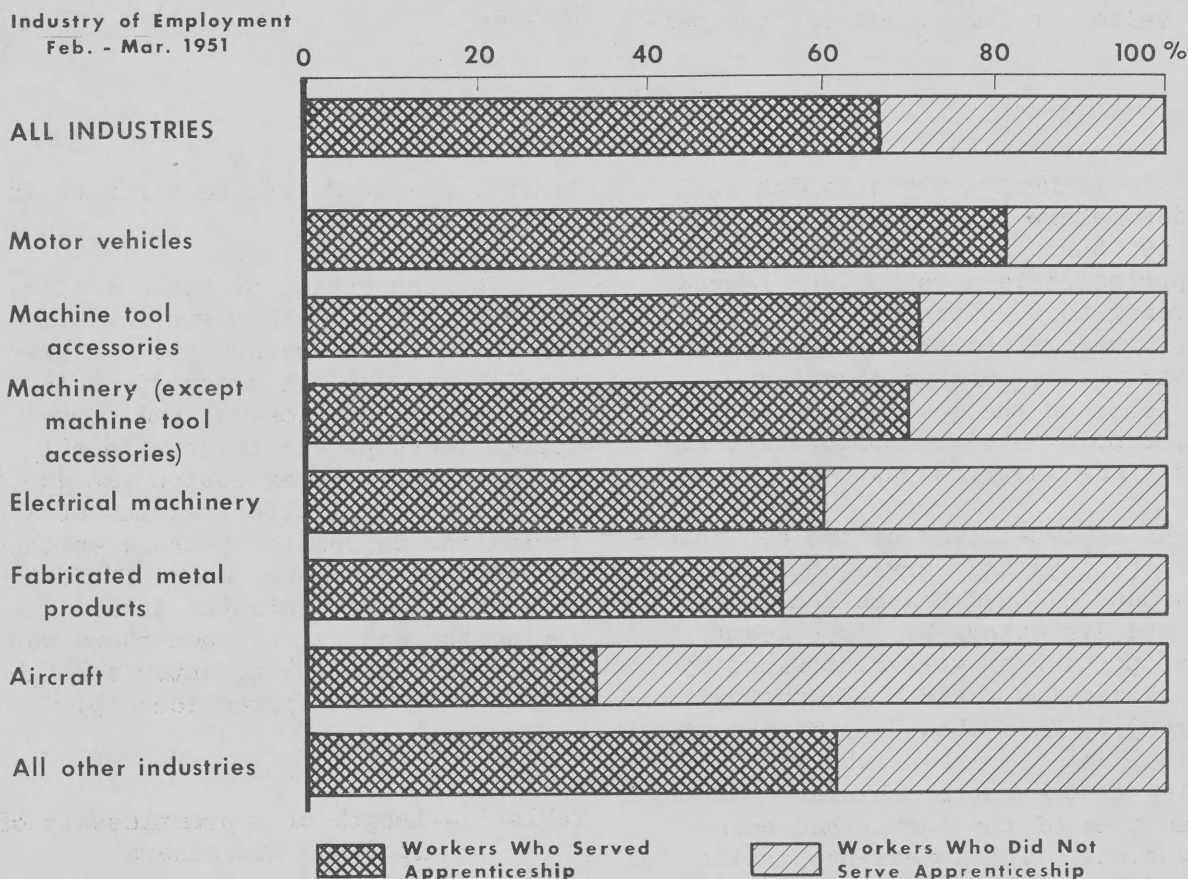
Table 3.--Length of apprenticeship of tool and die makers

Years	Workers	
	Number	Percent
All apprenticeship periods....	1,135	100.0
2 years or less.....	78	6.8
3 years.....	222	19.6
4 years.....	699	61.6
5 years or more.....	128	11.3
Apprenticeship period not reported.....	8	.7



**Chart 9. Motor Vehicles Industry Has Highest Proportion of Apprentice-Trained Tool and Die Makers**

PERCENT OF WORKERS EMPLOYED IN SELECTED INDUSTRIES  
TRAINED BY APPRENTICESHIP AND OTHER MEANS



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Not all the apprentices had been trained as tool and die makers. Fifteen percent had had a machinist apprenticeship and had "worked up" to tool and die making. The proportion was especially high among the older workers.

The apprenticeship period usually lasted 4 years, about three-fifths of the workers reporting this length of training. Slightly more than 11 percent (128) reported a 5-year training period. More than twenty-five percent reported learning the trade in three or fewer years (table 3). Some

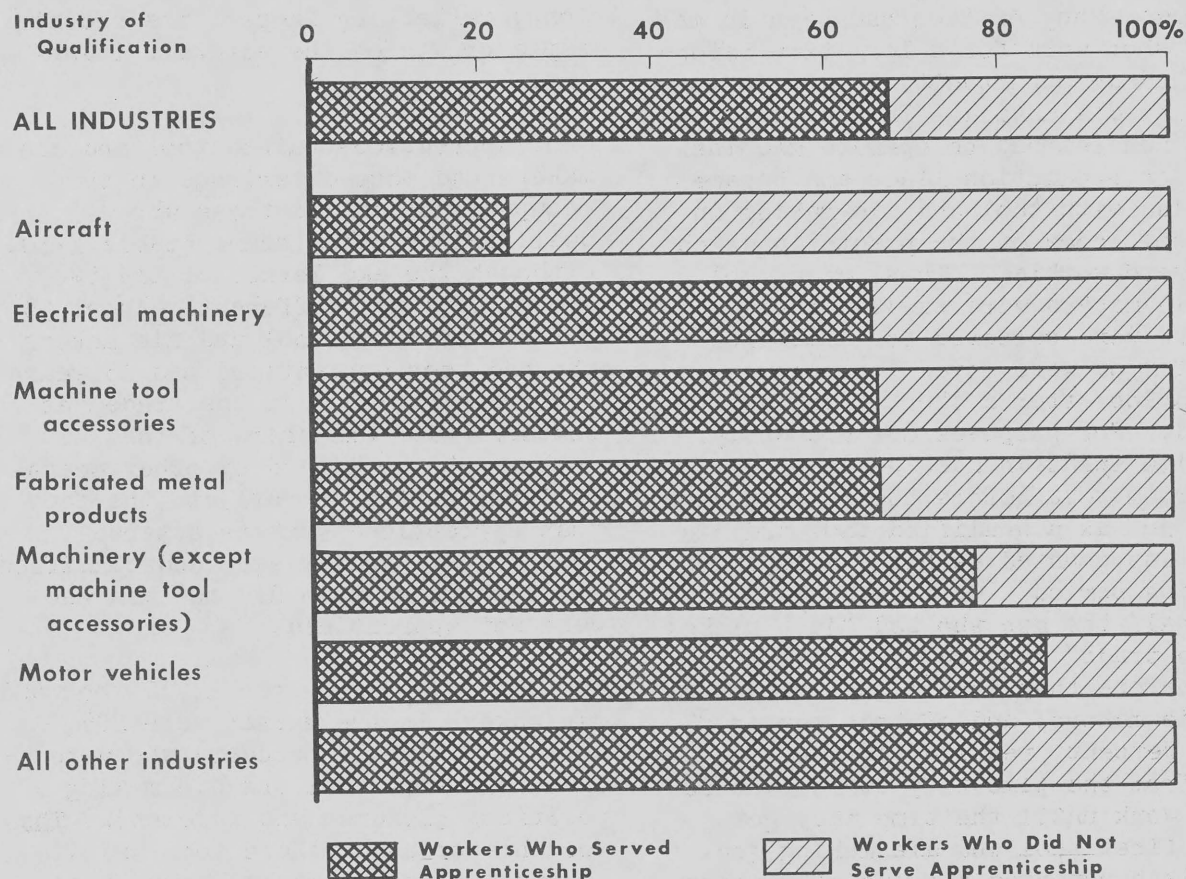
of those men had been able to qualify in shorter periods because they were given credit for previous experience in machine shop work or for vocational school training. In other cases, the workers were able to secure tool and die making jobs without completing their apprenticeships.

Many tool and die makers in the survey had not been trained through apprenticeship. For the group as a whole, about one-third were not apprenticed. However, during World War II almost half the tool and die makers who entered the trade had not



**Chart 10. Aircraft Industry Trained Smallest Proportion of Tool and Die Makers Through Apprenticeship**

PERCENT OF WORKERS QUALIFYING IN SELECTED INDUSTRIES THROUGH APPRENTICESHIP AND OTHER MEANS



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served apprenticeships, because many plants producing essential military and civilian equipment could not obtain enough journeymen tool and die makers, and there was not sufficient time to train new workers through apprenticeship. Tool and die maker requirements were met by upgrading partially trained men, or by intensively training untrained workers, as well as by "breaking down the job" and using the available tool and die makers as supervisors.

Of the tool and die makers who had not qualified by apprenticeship, about 20 percent had some other more-or-less formal on-the-job training by which they had progressively learned the different parts of the trade including the operation of various kinds of machine tools. These training programs were generally not covered by any formal oral or written agreement as to the length or scope of the training, but there was a definite agreement for the employee to learn

the trade while working. The majority of the men who did not serve apprenticeships had learned the trade either by "just picking it up" while working in tool rooms or machine shops, or had been upgraded from less skilled machine shop occupations. It is difficult to determine when this "learning" process began for these workers. Many of them had been in machine shop work for a long time before they had an opportunity to get into tool and die making. In many cases these men learned to operate machine tools on production lines and became familiar with tool and die making in the tool rooms of the plants in which they were working. Thus, when tool and die makers were needed, these workers were selected for immediate transfer or were moved into the occupation after a short training period. For purposes of this study, all time spent in machine shop or tool room work before the individual's first job as a qualified tool and die maker was counted as his qualifying or training period. On this basis more than half the men who had "just picked up the trade" required 5 years or more before they became qualified tool and die makers; and of this number 87, or 15 percent, required 10 years or more from the time they started in related work until the time they got their first tool and die making job. One-sixth reported 4 years of machine shop or tool room experience before qualifying as tool and die makers and about the same proportion qualified in 3 years or less. Ten percent of all the men who had not served apprenticeships had gained some knowledge of the trade by previous attendance at trade schools or vocational schools.

In general, the workers included in this survey had had considerable experience in tool and die making. About 20 percent of the tool and die makers in the survey reported 30 years or more experience in the trade and nearly half reported 15 years or more (table E-9). In contrast, less than one-seventh reported fewer than 5

years of experience. There were differences in the experience level of the tool and die makers employed in the various industries. Two-thirds of those employed in the motor vehicles industry had 15 years or more experience, whereas less than one-fourth in the aircraft industry had been active in the trade this long, reflecting in part the recent rapid growth of the aircraft industry.

Apprentice-trained tool and die makers had more experience in the occupation than did those who qualified by other means (table E-10), although the age levels of the two groups were not different. About 55 percent of these tool and die makers who had been apprenticed had 15 years or more experience in the trade, as compared with one-third of the workers who qualified by other means. In large part this reflects the fact that apprenticed workers entered training at earlier ages and qualified in fewer years than did the men who were not apprenticed.

Included among the 1,712 tool and die makers in the survey were 204 workers (about 12 percent) who were in supervisory tool and die making positions (leadmen and foremen). The work histories of these tool and die makers differed somewhat from those of the other 1,500 workers. Half the leadmen had 20 years or more experience in the trade, compared with about 37 percent of the remaining workers. The supervisory workers had had more experience in the trade even though their median age was lower. This can be partially explained by the fact that a higher proportion of these men were apprenticed and in general, those tool and die makers who were apprenticed had longer experience as tool and die makers in relation to their ages than did those who qualified by other means. Apparently, an apprenticeship gives a tool and die maker a somewhat better chance to

reach the supervisory level. Less than 10 percent of those who had not served apprenticeships were in the supervisory group whereas about 13

percent who had served apprenticeships were supervisors at the time of the survey (table E-11).

## Mobility

The findings in regard to mobility should be interpreted in the light of the particular economic conditions which affected tool and die makers during the years covered by the survey, 1940-51. In general, this 11-year period was one of favorable employment opportunities for tool and die makers. Tool and die making was the first occupation to be declared critical and to be subjected to wage controls during the defense and war production period of 1941-42. Tool and die makers remained in short supply throughout the war and were also urgently needed in the postwar reconversion period. Demands for these skilled workers continued strong during 1947 and 1948 because of high levels of metalworking activity. The outbreak of hostilities in Korea in June 1950 once again emphasized the importance of this occupation in tooling-up for defense production. The high level of tool and die maker employment prevailing during the period covered by the survey probably influenced the amount and character of job movement by tool and die makers. Few were laid off. In fact, employers were exerting every influence to retain their staffs during most of the period. On the other hand, the wide availability of jobs offered both the inducement and the opportunity for tool and die makers to change jobs for higher pay or better promotional opportunities or just to change when working conditions, personal relations, or plant location were not entirely to their liking.

Tool and die makers can find jobs in many places. They are employed in more than 9,000 plants throughout the country. They work in a large variety of metalworking industries and they are employed also in such nonmetalworking fields as the fabricated plastic products industry which employs die makers to make the metal molds. During World War II and also since the outbreak of hostilities in Korea government ordnance plants have employed a substantial number of these workers. Although the bulk of tool and die makers are employed in the midwestern and northeastern sections of the country where the metalworking industries are concentrated, tool and die makers are scattered throughout the Nation and there are some in every State.

The nature of the occupation itself influences the mobility of these workers. Qualified tool and die makers are at the top of the occupational ladder of skilled craftsmen and are among the highest paid workers in the metalworking field. Thus, members of this occupation are not afforded much opportunity for transfer on the same skill level, and because the period covered by the survey was primarily one of full employment, not many tool and die makers would be expected to be working below their highest skill level.

In general, tool and die makers are limited in their occupational



movement. They can move downward to other machine shop jobs requiring less skill such as machinists or machine tool operators. They can be promoted to supervisory jobs in tool rooms. A small number become tool or die designers, and hence are no longer members of the occupation. Some workers establish small tool and die shops of their own.

## MOVEMENT IN AND OUT OF THE OCCUPATION

The work histories of the tool and die makers in the survey showed very little movement in and out of the occupation. During the 11-year period, more than 90 percent of them worked only as tool and die makers after becoming qualified journeymen. Only 168 had worked outside the occupation, and these workers had done so only 209 times, or an average of 1.3 times

each. Even when the tool and die makers did move out of the occupation, they tended to work in closely related jobs. About half the jobs which these men held outside the occupation were either as machinists, machinery repairmen, or machine tool operators (table E-12). It should be noted again that the analysis of the work histories of these men began only after they became qualified journeymen and that the occupational movement involving a skill progression up to tool and die maker has been considered in this study as part of the training experience for the trade but has been excluded from the measurement of mobility of fully qualified members of this craft. As previously stated, men who had worked as tool and die makers during the 11-year period but were working in some other occupation when the study was taken were not included in the study. Thus, this survey does not fully reflect shifts to other occupations.

Table 4.—Distribution of tool and die makers,  
by number of job changes, 1940-51

Number of changes	Total tool and die makers making specified number of job changes		Number of changes made	
	Number	Percent	Number	Percent
Tool and die makers.....	1,712	100.0	2,127	100.0
No change.....	979	57.2	-----	-----
One change.....	216	12.6	216	10.2
Two changes.....	193	11.3	386	18.1
Three changes.....	95	5.5	285	13.4
Four changes.....	83	4.8	332	15.6
Five changes.....	62	3.6	310	14.6
Six or more changes.....	84	5.0	598	28.1

## MOVEMENT BETWEEN EMPLOYERS

In terms of manpower mobilization planning, the importance of mobility lies primarily in the amount of movement of workers to the plants and industries where they are most needed in a mobilization period. After the general level of movement has been determined, there must also be established the extent to which those workers who do change employers are also willing and able to move across industry lines and from one geographic area to another.

All of the industry and geographic shifts made by the workers included in this study, as well as most of the moves in and out of the occupation, involved changes of employer (table 5). Measurement of movement between employers was, therefore, a comprehensive measurement of all movement made by these tool and die makers and offered the broadest basis for analysis. Thus, movement between employers was the principal criterion of mobility in this study.

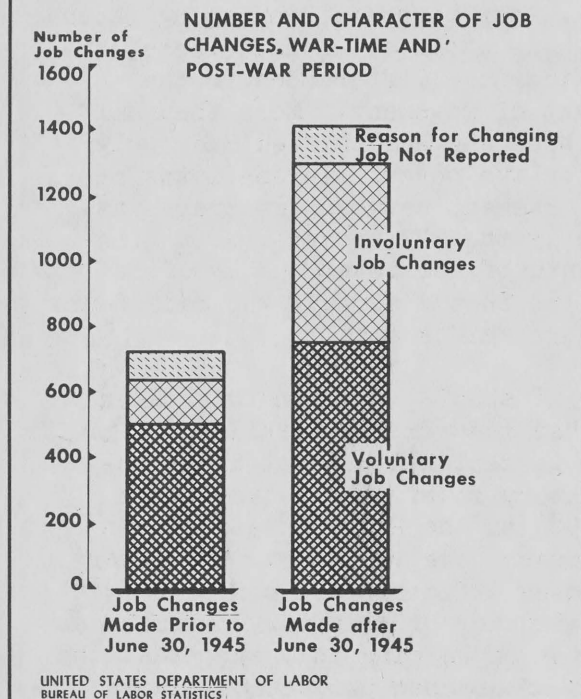
Table 5.--Job changes of tool and die makers by type of job change, 1940-51

Type of job change	Workers	
	Number	Percent
All changes...	2,127	100.0
Employer only.....	700	32.9
Employer and industry.....	1,177	55.3
Employer and location.....	62	2.9
Employer, industry, and location.....	188	8.9

Nearly three-fifths (979 of the 1,712 workers in the survey) had worked for only one employer (table 4). The 733 tool and die makers who had changed employers one or more times made 2,127 moves, or an average of 2.9 per person. Even among those who made employer changes there were considerable differences in the amount of movement. More than half of those who had shifted made only one or two moves. Three-fifths of the movement between employers was made by the 229 workers (about one-seventh of the total number of workers in the survey) who made four or more shifts each.

Of the 733 tool and die makers who had made employer shifts 605 or 82.5 percent had made at least one voluntary move. About two-thirds (1,258) of the 2,127 moves between employers were voluntary. Manpower planning officials are concerned with the adequacy of voluntary movement as a means of helping to insure that the needs of defense production plants for skilled workers are filled, although they are aware that excessive movement may hamper production. Thus, the emphasis of this study should be placed upon voluntary movement. Some idea of the amount of voluntary movement which was found in this study may be obtained by estimating the number of voluntary job changes which might be made in a single year. If the frequency of voluntary movement between employers of the estimated 100,000 tool and die makers now employed was the same as was found for the 1,712 tool and die makers in the sample during the 11 years covered by the survey, it is estimated that about 9,000 voluntary employer shifts would be made annually by the tool and die makers in the country. Most of the job changes would involve a change of industry, but less than 12 percent of the shifts would involve a change of employment from one labor market to

**Chart 11. Rate of Job Changes  
of Tool and Die Makers  
Higher in Post-War Period**



the period was divided into two parts-- before and after June 30, 1945. The first part roughly corresponded to the tooling-up and war production period, the second to the postwar conversion and prosperity period. A comparison of the two periods shows considerable differences (chart 11). About twice as much movement occurred in the second of the two periods; 722 moves were made before June 30, 1945, and 1,405 were made after that date. Also, the nature of the movement differed. During the first 5 1/2 years only one-fifth of the total moves were involuntary. The proportion of involuntary moves was twice as great after June 30, 1945. The number of voluntary moves in the later period was about 50 percent more than in the first period. On the other hand, the number of involuntary moves was four times as great as the first 5 1/2 years. The difference in the amount of voluntary movement between the two periods can be partly accounted for by the 63 voluntary moves made in the later period to return to former employers from whom the workers had previously been laid off.

another. <sup>16/</sup> It should be borne in mind that 9,000 job changes does not mean that 9,000 different tool and die makers would change employers, since a small number of men might change jobs more than once during a given year.

It was found, however, that the ratio of voluntary to involuntary movement was about the same for all workers no matter how they were grouped, except in a few specific cases which are noted in the following analysis. Consequently, most of the tabulations are presented in terms of total movement. The conclusions based upon these tables, however, are the same as if the data were for voluntary movement only.

As noted earlier, the 11 years of the survey covered changing economic conditions. For analytical purposes

The amount of movement between employers was affected by such factors as age, education, and length of time in the labor force during this period. It also varied by industry and city of employment. On the other hand, such other characteristics as marital status, method of training, and nativity of these tool and die makers did not appear to affect the amount of movement.

Older workers did not change jobs as often as the younger men. A higher proportion had worked for only one employer (table 6). Of the 403 workers who were 55 years of age or older at the time of the survey, 289 (71.7 percent) had worked for only one employer during this period. On the other hand, 52.7 percent of those

<sup>16/</sup> See pp. 39-41 for discussion of interindustry and geographic movement.



workers under 55 had worked for only one employer. In addition, those in the higher ages who did change jobs made fewer shifts per person than those in the younger age groups. It should be noted, however, that the above comparisons do not give a precise measurement of the effect of age upon mobility, because they are a comparison of groupings of workers by age at the time of the survey. Such a grouping gives only the experience of workers in each age group. It does not describe the mobility behavior characteristic of particular ages.

To measure this, the number of moves made by workers when they were at given ages was related to the number of years worked by all the workers in the survey at those same ages (table 7). It was found that relatively more movement occurred at lower ages and that the rate of movement diminished as the workers grew older. For example, almost four times as many moves relative to the number of man-years worked at the given ages were made by workers when they were between the ages of 20-29 years as were made by workers when

Table 6.--Job changes of tool and die makers, by age, February-March 1950

Age group	Total tool and die makers	Tool and die makers who changed employ- ers one or more times		Total number of job changes	Average number of job changes made by---	
		Number	Percent		All tool and die makers	Tool and die makers who changed employ- ers one or more times
All age groups...	1,712	733	42.8	2,127	1.2	2.9
20 - 24.....	9	-----	-----	-----	-----	-----
25 - 29.....	132	53	40.2	146	1.1	2.8
30 - 34.....	325	162	49.5	497	1.5	3.1
35 - 39.....	250	122	48.8	382	1.5	3.1
40 - 44.....	184	84	45.7	279	1.5	3.3
45 - 49.....	193	100	51.8	299	1.5	3.0
50 - 54.....	216	98	45.4	251	1.2	2.6
55 - 59.....	199	64	32.2	160	.8	2.5
60 - 64.....	121	33	27.3	78	.6	2.4
65 and over.....	83	17	20.5	35	.4	2.1

they were 55 years of age or older. The foregoing analysis confirms the thesis that as workers grow older they tend to become less mobile. Among the probable factors responsible are seniority, pension rights, and a greater desire for stability.

A grouping of tool and die makers by the number of months they were in the labor force in the period covered by the survey showed differences in mobility. Workers with fewer months in the labor force after qualifying as tool and die makers made proportionately more job changes in relation to the length of their work experience (table E-14). While age differences were an important factor, there were differences even for workers in the

same age group. The relationship between months in the labor force and degree of mobility tends to substantiate the belief that when workers enter the labor market, either as new workers, or as in this case, as new journeymen, they look for "good" jobs. In this search they move from job to job until they find one that satisfies their requirements, and once they obtain such a position, they are likely to remain there. <sup>17/</sup>

The amount of movement varied with the number of years of schooling. To a considerable extent, the educational level is also related to age. It was found, however, that when years of schooling were standardized by age, the influence of education on mobility persisted. There was a high correlation between the average number of moves per person and educational level; the average number of job changes increased with the number of years of schooling (table 8). Those tool and die makers who had not gone beyond the eighth grade averaged less than one job change per worker; those who had partial or complete high school education had made an average of 1.3 changes. Men with some college training had the highest rate of movement, averaging nearly two job changes each.

The rate of movement between employers varied when the tool and die makers were grouped by industry of employment at the time of the survey. Slightly more than a quarter of the workers employed in the machinery and motor vehicles industry had changed employers; in comparison, more than half the workers employed in the aircraft industry and about two-thirds of those working in the machine tool accessories industry had changed jobs during the period (table 9). Although the average age of the workers differed by industry and was to some extent a

Table 7.--Job changes of tool and die makers by age at time of change, 1940-51

Age	Total job changes	Total man-years worked 1940-51 1/	Average changes per man-year worked
All ages	2,127	14,987	.142
20-24....	145	719	.202
25-29....	453	2,143	.211
30-34....	451	2,218	.203
35-39....	308	1,874	.164
40-44....	262	1,978	.132
45-49....	259	2,173	.114
50-54....	141	1,859	.076
55-59....	75	1,184	.063
60 or more	33	839	.039

<sup>1/</sup> Excludes period before qualifying as tool and die maker.

<sup>17/</sup> For example, see Reynolds, Lloyd G., *op. cit.*, p. 111.

factor, the interindustry differences in mobility still appeared when age was held constant. These differences may be partially explained by the nature of the industries, particularly their recent growth and the degree to which employment has fluctuated. For example, only about half the tool and die makers employed in the machine tool accessories industry had qualified as tool and die makers in that industry. Thus, the other 50 percent would necessarily have made at least one job (and industry) move in order to be employed in a machine tool accessories plant. (Some of these men may have come into the industry before 1940; hence, this movement into the industry would not have been counted in this study.)

Differences in mobility appeared also among the various cities in the survey. These closely followed the pattern of interindustry variations. The highest proportion of workers who had changed employers was found in Hartford and Los Angeles, both wartime aircraft production centers where more than half the workers had changed employers at least once (table E-15). In Detroit, the workers for example, had made about the same average number of moves as had all the workers in the survey. This city had concentrations of tool and die maker employment in both the industry with the highest rate of movement (machine tool accessories) and in the industry with the lowest rate (motor vehicles). The average number of moves for those workers who did change employers varied among the cities. The average number of shifts per worker was highest in Los Angeles, where the mobile workers made an average of 3.6 moves each. Although more than half the workers in Hartford had changed employers, most of them had made only one or two shifts. Thus, in this city

the average number of shifts per worker who changed employers at least once was the lowest for all seven cities. This probably can be attributed to the fact that there are relatively fewer employers of tool and die makers in Hartford as compared to some of the other cities in the survey. Because of this, the number of alternative employment opportunities for tool and die makers in that city was limited.

The effects of several other factors upon mobility were investigated. Persons trained by apprenticeship and those trained by other methods showed no appreciable differences in the rate of movement. The percentage of men who had changed employers at least once was about the same for each group and the number of moves per person was also the same. Among the tool and die makers included in this study, married men changed employers just as frequently as men who were not married (table E-16). The effect of marital status on mobility was measured by observing the number of job changes which were made by men married at the time they moved and the number of job changes made by men unmarried at the time they changed employers, relative to the number of man-years worked by married men and unmarried men.

Foreign-born tool and die makers moved proportionately as much as native-born tool and die makers, and about the same percentage of each group had changed employers one or more times. The tool and die makers who recommended this trade as a career for young people had moved relatively as much as those who did not make this recommendation.



Table 8.—Job changes of tool and die makers, by educational level,  
February–March 1951

Highest school grade completed	Total tool and die makers	Total number of job changes	Average number of job changes
All educational levels.....	1,712	2,127	1.2
1 - 4.....	22	8	.4
5 - 8.....	490	464	.9
9 - 12.....	1,088	1,462	1.3
Total with some college education..	100	179	1.8
Education not reported.....	12	14	1.2

Table 9.—Job changes of tool and die makers,  
by industry of employment, February–March 1951

Industry	Total tool and die makers	Tool and die makers who changed employers one or more times			
		Number	Percent	Number of changes made	Average number of changes made
All industries.....	1,712	733	42.8	2,127	2.9
Fabricated metal products.....	159	56	35.2	170	3.0
Machinery (except machine tool accessories)	284	81	28.5	235	2.9
Machine tool accessories	446	282	63.2	861	3.1
Electrical machinery....	260	104	40.0	272	2.6
Motor vehicles.....	358	99	27.7	239	2.4
Aircraft and parts.....	151	83	55.0	262	3.2
All other.....	54	28	51.9	88	3.1

## MOVEMENT BETWEEN INDUSTRIES

Although less than half the tool and die makers made no job changes, those who did move had no strong industry attachments. Of the 733 workers who changed employers, 553 had worked in more than one industry and of the 2,127 job changes nearly two-thirds involved a change in industry. In all, about one-third of the tool and die makers in the survey worked in more than one industry during the period covered by the survey. A small number of workers accounted for the bulk of the movement between industries. Slightly more than 10 percent of the tool and die makers had made almost three-fifths of the industry moves.

The tool and die makers employed in some industries at the time of the survey had made more industry shifts than those employed in other industries. For example, about 16 percent of the tool and die makers employed in the motor vehicles industry when they were interviewed had worked in at least one other industry, whereas 43 percent of those employed in the machine tool accessories plants had been employed in other industries (table 10).

Even though the tool and die makers employed in some industries had moved less than those in others, it appeared that all tool and die makers could cross industry lines freely. Each of the industries had drawn some tool and die makers from each of the other industries included in the survey. In fact, in every industry studied at least one-third of the workers had not qualified as tool and die makers in the industry in which they were working at the time of the survey. With one exception, no pattern of movement from one industry to another was evident. This exception was due primarily to the geographic concentration of particular industries. The automobile and machine tool accessories industries, both of which have large concentrations in Detroit, showed a higher than average interchange of tool and die makers.

The effect of various factors on movement between industries was the same as in the case of employer changes. In particular, it should be noted that apprentice-trained workers showed about the same rate of industry shifting as did workers who qualified by other means.

## MOVEMENT FROM ONE GEOGRAPHIC AREA TO ANOTHER

There was relatively little movement from one geographic area to another by the tool and die makers in the survey. Only 143 (8.4 percent) of the 1,712 men reported changing their cities of employment <sup>18/</sup> during the 11 years, and these men made only 250 such shifts in job location or an average of 1.7 moves each. Nearly half of those who had changed their

cities of employment moved only once, and five-sixths had made only 1 or 2 locational moves.

Two-thirds of the movement between geographic areas occurred in the second half of this 11-year period, as was true for movement between employers. The proportion of moves between geographic areas which

<sup>18/</sup> "City of employment" refers to Census standard metropolitan areas.

Table 10.--Number of industries in which tool and die makers were previously employed, by industry of employment, February-March 1951

Industry of employment at time of survey, February-March 1951	Total tool and die makers		Number of industries previously worked in				
	Number	Percent	None	One	Two	Three	Four or more
All industries..	Percent						
All industries..	1,712	100.0	67.7	18.3	10.0	2.7	1.3
Fabricated metal products.....	159	100.0	68.6	18.8	4.4	3.8	4.4
Machinery (except machine tool accessories).....	284	100.0	74.3	13.4	10.2	1.8	.3
Machine tool accessories.....	446	100.0	57.4	25.1	13.7	3.4	.4
Electrical machinery	260	100.0	63.8	20.9	8.8	4.6	1.9
Motor vehicles.....	358	100.0	83.5	12.0	3.6	.6	.3
Aircraft and parts..	151	100.0	60.3	17.9	17.8	2.0	2.0
All other.....	54	100.0	50.0	14.8	20.4	7.4	7.4

followed losses of jobs increased in the second half of the period, undoubtedly because of the increased importance of involuntary employer shifts during the second half of the period. In the earlier period, 19 percent of the geographic changes followed losses of jobs whereas in the later period 28 percent followed job losses.

Most of the workers who moved into the seven metropolitan areas in

which the survey was taken came from the surrounding regions <sup>19/</sup> (table E-18). The one exception was found in Los Angeles. Forty-five of the 160 tool and die makers interviewed in Los Angeles had moved into the city during the 11 years covered by the survey. <sup>20/</sup> More than half of these 45 workers had come from the industrial centers of the Midwest, and only 6 had come from any of the Pacific Coast States. The relative geographic immobility of these

<sup>19/</sup> "Region," as used in this study, corresponds to standard Census geographic divisions such as New England and Middle Atlantic.

<sup>20/</sup> These 45 men were already qualified tool and die makers when they moved to Los Angeles. In addition, a few workers moved to Los Angeles during this period from other cities and qualified as tool and die makers through their first job in Los Angeles.



workers is shown by the fact that less than 5 percent of the tool and die makers trained in this country were working outside the region where they were trained.

As was true of job changes which involved only changes of employer, younger workers and workers

with more schooling changed their city of employment relatively more often. However, although marital status did not affect the rate of movement between employers, unmarried tool and die makers changed cities of employment proportionately twice as often as did the married workers (table E-17).

Table 11.--Job changes of tool and die makers, by nature of change and reason for voluntary changes, selected periods, 1940-51

Job changes	Period of change					
	Entire period 1940-51		Before June 30, 1945		After June 30, 1945	
	Number	Percent	Number	Percent	Number	Percent
All job changes.....	2,127	100.0	722	100.0	1,405	100.0
Voluntary.....	1,258	59.1	507	70.2	751	53.4
Involuntary.....	675	31.7	130	18.0	545	38.8
Reason not reported....	194	9.2	85	11.8	109	7.8
Voluntary changes....	1,258	100.0	507	100.0	751	100.0
Better pay.....	.....	27.5	.....	30.0	.....	25.8
Better job.....	.....	24.9	.....	27.6	.....	23.0
Working conditions.....	.....	11.6	.....	12.8	.....	10.8
Location.....	.....	5.1	.....	6.1	.....	4.4
Return to former employer.....	.....	5.0	.....	.....	.....	8.4
Differences with foreman.....	.....	3.3	.....	3.4	.....	3.3
Other.....	.....	22.6	.....	20.1	.....	24.3

## Reasons for Changing Jobs

This discussion has centered, so far, on the extent and magnitude of mobility, the proportion of workers who changed jobs, and the number of job changes. Those groups of workers who changed jobs most frequently have also been identified. In manpower planning it is necessary to know not only how much movement might be expected and which workers would be most likely to change jobs, but also what inducements would cause workers to change jobs if such movement should be desirable in a mobilization period.

The tool and die makers interviewed were asked to give their reasons for changing jobs. The information called for the entire explanation for changing employers including both the reason for leaving a particular job and for taking the next one. The reasons given were divided into two broad groups: job changes made as a result of the worker's own choice and job changes made as a result of factors over which the worker had no control. Of the 2, 127 job changes 1,258 were voluntary, and 675 were involuntary. In 194 cases the workers either gave no reason or the reason was so vague as to be unclassifiable (table 11). Of the changes made voluntarily, 27.5 percent were due to the desire for higher pay, including a higher wage rate or higher take-home pay because of a longer workweek. This was the most frequently given reason. The next largest category accounted for almost 25 percent of all the voluntary job changes, and covered a variety of responses which could be summed up as a desire to get a "better job." This included such reasons as "to gain experience," "to get a promotion," or "to take a job which would lead to promotion."

The desire to improve working conditions accounted for 12 percent more of the voluntary changes made. Included in this group were changes made to secure different work shifts, more desirable hours of work, or better physical conditions in the tool room or shop. Five percent of the job changes were made because of plant location or transportation difficulties. In another five percent of the changes, the workers left jobs to return to plants where they had formerly worked and from which, in most cases, they had been laid off. More than three percent of the job changes were made because of "differences" with supervisors.

In about 23 percent more of the voluntary job changes, vague reasons or reasons not related to a particular job were given. These included such comments as "dissatisfied," "wanted a change," "entered defense work," "quit to help out family business," and "wanted to live in California." A large group said they "just quit" and were unable or unwilling to give more specific reasons, indicating that they "just got tired of working at that job."

The above enumeration of reasons for changing jobs suggest the important conclusion that most of the voluntary movement of tool and die makers was for specific and rational reasons calculated to improve the worker's job situation.

About one-third (675) of all the job changes were involuntary, resulting from factors over which the worker had no control. All but a small number of these job changes were the result of lay-offs. The remainder were due to the worker's

being discharged by the employer for one reason or another or because the worker's health did not permit him to continue on the job.

The reasons for voluntary job changes made before June 30, 1945, were compared with those given after that date. The distribution of reasons was about the same, except that after June 30, 1945, 8.4 percent of the voluntary job changes were made to return to former employers. This reason was not given for any job changes occurring in the earlier period. Thus, it appears that although the amount of voluntary job changing did vary, the reasons for this movement were about the same both in the wartime and postwar periods.

In general, the importance of the reasons for changing jobs was similar for the various groups of tool and die makers. There were no significant differences in distribution of reasons between apprentice-trained men and those who qualified by other methods, between younger men and older workers, between experienced workers and relatively new workers, or between native-born and foreign-born

men. There was one exception--marital status. Married men were apparently more concerned than unmarried men with working conditions and with "better jobs" in terms of opportunity for promotion or experience, and had changed jobs relatively more often to return to former employers. On the other hand, unmarried men moved more often for better immediate pay, for a different working location, or because of differences with their supervisors.

The distribution of reasons for making industry changes was the same as the reasons for changing employers. The reasons for job changes involving movements between geographic areas, however, were considerably different. Of the 250 geographic changes, 54 occurred after the worker was laid off or discharged. The geographic changes which did not follow lay-off or discharge were grouped by the reasons given for making the job change. More than two-fifths were made for personal reasons not apparently related to the job; three-eighths were for better pay, better jobs, and more desirable working conditions. (This compares with more than 60 percent of all voluntary changes of employers in which these reasons were given).



Appendix A: Definitions Used in This Survey

1. Job description of tool and die maker (Die maker; jig maker; tool maker; fixture maker; gage maker)

Constructs and repairs machine shop tools, gages, jigs, fixtures or dies for forgings, punching, and other metal-forming work. Work involves most of the following: planning and laying out of work from models, blueprints, drawings or other oral or written specifications; using a variety of tool and die maker's hand tools and precision measuring instruments; understanding of the working properties of common metals and alloys; setting up and operating of machine tools and related equipment; making necessary shop computations relating to dimensions of work, speeds, feeds, and tooling of machines; heat-treating of metal parts during fabrication as well as of finished tools and dies to achieve required qualities; working to close tolerances; fitting and assembling of parts to prescribed tolerances and allowances; selecting appropriate materials, tools, and processes. In general, the tool and die maker's work requires a rounded training in machine shop and tool room practice usually acquired through a formal apprenticeship or equivalent training and experience.

2. Job changes per month in the labor force after qualifying as tool and die maker

A test was devised to measure the relationship between exposure to the labor force and mobility. In essence, this consisted of dividing the number of months each worker had spent in the civilian labor force as a tool and die maker by the number of job changes he made. The result is the changes per month in the labor force. (In actual computation the data were grouped as shown in table E-14, and man-years rather than man-months were used). The amount of movement for each grouping of tool and die makers was determined. For example, it was found that those tool and die makers who were in the labor force 5 years or less made an average of about one more every 5 years. On the other hand, those who were in the labor force as tool and die makers the entire 11 years made on the average about one ~~move~~ every 9 years. Thus, the figures shown have an advantage over a simple tabulation of the number of changes made by men in each grouping, inasmuch as they relate the amount of movement to the potential for movement.

### 3. Job changes per man-years worked at given ages

Although a grouping of workers by their ages at the time of the survey and by the number of job changes they made during the 11-year period covered by the survey gives an approximation of the effect of age on mobility, it has certain weaknesses. The first of these is that it tends to give the impression that the older workers moved more often than was actually the case. This impression is given because the older workers in general were in the labor force longer during the period covered by the survey than were the younger workers. Thus, if the mobility rates of the various age groups were equal, the older workers would have made more moves. The second weakness is that a grouping of workers by ages attained at the time of interview does not recognize that the job changes were made in the past and therefore were made at lower ages; in some cases as many as 11 years lower than the ages at the time of the survey. A better measure of the effect of age on the rate of movement is the average number of man-years worked at specified ages.

To isolate the effect of age, the movements of workers were grouped by the ages at which the movement occurred. Thus, of the 2,127 job changes, 145 were made by workers who were 20-24 years old when they moved, 453 by workers who were 25-29 when they moved, and so forth. Following this, the man-years worked at given ages were computed. For example, a worker who qualified as a tool and die maker before 1940, and who was 25 years of age on January 1, 1940, would have worked five man-years in the age group 25-29, five man-years in the age group 30-34, and one man-year in the age group 35-39. After the man-years were accumulated for each age group, they were divided by the number of moves made at those ages. The result, moves per man-year worked at specified ages, describes the mobility characteristic of a particular age.

## Appendix B: Statistical Test of Significance

The following form of the Chi-square formula was used to test the significant differences of the data in this study:

$$\chi^2 = \sum \frac{(f_o - f_t)^2}{f_t}$$

where  $f_o$  = observed frequency

and  $f_t$  = hypothetical frequency

The value of  $P = 0.05$  was used to define the level of significance.



Calculation of estimated separations of tool and die makers because of retirement and death, 1951-61

Age	Estimated employment 1951  (1)	Five-year period, 1951-56		Ten-year period, 1951-61	
		Separation rate <sup>1/</sup> per 1,000 in the labor force (estimated) (2)	Number of separations (estimated) (1) x (2) (3)	Separation rate <sup>1/</sup> per 1,000 in the labor force (estimated) (4)	Number of separations (estimated) (1) x (4) (5)
All age groups....	100,000	107.6	10,758	229.4	22,939
20 - 24.....	500	11.3	6	23.8	12
25 - 29.....	7,700	12.6	97	33.0	254
30 - 34.....	19,000	20.7	393	52.5	998
35 - 39.....	14,600	32.5	475	78.9	1,152
40 - 44.....	10,700	47.9	513	119.9	1,283
45 - 49.....	11,300	75.6	854	174.2	1,968
50 - 54.....	12,600	106.7	1,344	250.0	3,150
55 - 59.....	11,600	160.5	1,862	458.3	5,316
60 - 64.....	7,100	354.7	2,518	678.5	4,817
65 - 69.....	3,600	501.8	1,806	-----	-----
70 - 74.....	900	544.3	490	-----	-----
75 and over.....	400	1,000.0	400	-----	-----
65 and over.....	4,900	.....	.....	814.1	3,989

<sup>1/</sup> Based on separation rate for total males adapted from abridged table of working life for 1947, in "Tables of Working Life," Bureau of Labor Statistics, Bulletin 1001.

UNITED STATES DEPARTMENT OF LABOR  
BUREAU OF LABOR STATISTICS  
WASHINGTON 25, D. C.

*Confidential**Confidential*

## OCCUPATIONAL MOBILITY OF TOOL AND DIE MAKERS

1. Name \_\_\_\_\_ Soc. Sec. No. \_\_\_\_\_ Establishment identification: \_\_\_\_\_  
 2. Address \_\_\_\_\_ Firm name \_\_\_\_\_  
 3. Marital status \_\_\_\_\_ City \_\_\_\_\_  
(GIVE DATES FOR OTHER THAN SINGLE)  
 4. Number of dependents \_\_\_\_\_ 5. Year of birth \_\_\_\_\_ 6. Place of birth (City or county and State, or foreign country) \_\_\_\_\_  
 7. Education: Highest grade completed \_\_\_\_\_  
 8. Year completed \_\_\_\_\_ First full-time job: 9. Year \_\_\_\_\_ 10. Occupation \_\_\_\_\_  
 11. Industry (or principal product) \_\_\_\_\_

How did you learn to be a tool and/or die maker? (For those who served any apprenticeship, complete question 12; for those who did not, complete applicable questions under 13.)

12. Served apprenticeship \_\_\_\_\_ 13. Did not serve apprenticeship \_\_\_\_\_
- a. What occupation \_\_\_\_\_ Specify in which of the following ways you qualified to be a tool and/or die maker:  
 b. Firm name \_\_\_\_\_  
 c. Industry \_\_\_\_\_  
(OR PRINCIPAL PRODUCT)  
 d. Location \_\_\_\_\_  
(CITY OR FOREIGN COUNTRY)  
 e. Number of years served \_\_\_\_\_  
 f. Did you complete apprenticeship \_\_\_\_\_  
 g. Date completed \_\_\_\_\_
- h. If apprenticeship was not completed, relate steps taken to qualify as a tool and/or die maker: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- i. If apprenticed in an occupation other than tool and/or die maker, relate steps taken to qualify as tool and/or die maker: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- b. Upgraded from machinist or similar job with additional training in plant. (Give details including occupation from which upgraded): \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- c. Picked up tool and/or die trade while working as a machine tool operator, machinist, etc. (give details): \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- d. Other \_\_\_\_\_
- e. Number of years to qualify as a tool and/or die maker \_\_\_\_\_

(Turn to page 4)

[illegible]

19. Number of weeks out of work in 1949 \_\_\_\_\_ Give reasons for each period \_\_\_\_\_

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e.

Remarks: (Explain reason for changing employment or steps resulting in changing occupation)

Indicate specialization for present job only

16. Technical schooling other than that taken as part of apprenticeship:

Name of courses	Name of school	From		To	
		Mo.	Yr.	Mo.	Yr.

20. *Remarks:* Include respondent's statement as to what influences led to the selection of this trade and his opinion about the trade as a career for young people. Also specifically indicate:

1. Whether there are other members of his respondent's immediate family in this trade, 2 the occupation and industry of his father's longest or usual job, and 3. whether respondent was raised on a farm.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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UNITED STATES DEPARTMENT OF LABOR  
BUREAU OF LABOR STATISTICS  
WASHINGTON 25, D. C.

## OCCUPATIONAL MOBILITY OF TOOL AND DIE MAKERS

## ESTABLISHMENT INFORMATION

*Confidential**Confidential*

1. Firm name \_\_\_\_\_ (IDENTIFY PLANT)
2. Plant address \_\_\_\_\_  
(STREET AND NUMBER)
3. City and State \_\_\_\_\_ 4. Date \_\_\_\_\_
5. Names and titles of officials interviewed \_\_\_\_\_
6. Principal products \_\_\_\_\_ Industry \_\_\_\_\_
7. Employment: a. Total \_\_\_\_\_ b. Number of production (plant) workers \_\_\_\_\_  
c. Number of workers in tool and/or die department \_\_\_\_\_  
d. Number of fully qualified tool and/or die makers in tool and/or die department \_\_\_\_\_  
e. Number of fully qualified tool and/or die makers in plant \_\_\_\_\_  
f. Number of fully qualified tool and/or die makers in plant over 55 years of age \_\_\_\_\_  
g. Specify pay period applying to employment data \_\_\_\_\_
8. What is the principal use of the tool and/or die department (indicate proportions, if possible, or order of importance): a. Making tools and/or dies for sale \_\_\_\_\_  
b. Making tools and/or dies for own use in production \_\_\_\_\_ c. Reconditioning and repair of tools and/or dies \_\_\_\_\_ d. Other (specify) \_\_\_\_\_
9. What is the job organization in tool and/or die room (indicate proportions, if possible, or order of importance): a. A tool and/or die maker produces a complete unit \_\_\_\_\_  
b. Qualified tool and/or die maker acting as lead man supervises crew producing complete units \_\_\_\_\_  
c. Tool and/or die maker in charge of job, routes operations through machine operators and other specialists and fits and assembles final product \_\_\_\_\_  
d. Jobs broken down so that foreman supervises workers other than fully qualified tool and/or die makers who repetitively perform a separate operation such as machining on a turret-lathe \_\_\_\_\_  
e. Some other arrangement (specify) \_\_\_\_\_



10. Usual sources of obtaining tool and/or die makers for plant (indicate proportion, if possible, or order of importance): a. Hiring experienced tool and/or die makers from outside the plant \_\_\_\_\_ b. Apprenticeship program \_\_\_\_\_ c. On-the-job training in tool and/or die making, other than apprenticeship \_\_\_\_\_ If c, what is the average length of time required to qualify? \_\_\_\_\_ d. Upgrading other machine shop or related workers from within the plant? \_\_\_\_\_ From what occupations are such people drawn? \_\_\_\_\_
- \_\_\_\_\_
- e. Hiring machine shop or related workers from outside the plant to be trained or up-graded for tool and/or die maker jobs \_\_\_\_\_ f. Other (specify) \_\_\_\_\_
- \_\_\_\_\_
11. Apprenticeship: a. Is there an apprenticeship program for tool and/or die makers in the plant? \_\_\_\_\_ b. If "yes", is the program registered (with Federal Committee on Apprenticeship or State Apprenticeship Council)? \_\_\_\_\_ c. Number of tool and/or die maker apprentices now in training \_\_\_\_\_ d. Number of tool and/or die makers completing apprenticeship in the plant in: 1947 \_\_\_\_\_ 1948 \_\_\_\_\_ 1949 \_\_\_\_\_ 1950 \_\_\_\_\_ e. Number still working in the plant of those who completed apprenticeship in: 1947 \_\_\_\_\_ 1948 \_\_\_\_\_ 1949 \_\_\_\_\_ 1950 \_\_\_\_\_
12. In temporary slack periods in the tool and/or die room, are tool and/or die makers usually— a. Laid off? \_\_\_\_\_ or, b. Given other work? \_\_\_\_\_ If the latter, what occupation or type of work is usually assigned? \_\_\_\_\_
13. In the past when it was necessary to increase production of tools and dies sharply, how were the additional manpower requirements met, aside from increasing hours of work? (Indicate proportion if possible, or order of importance): a. Hiring experienced tool and/or die makers? \_\_\_\_\_ b. Increasing the number of apprentices? \_\_\_\_\_ c. Utilizing less skilled workers supervised by the skilled men already employed? \_\_\_\_\_ d. Intensive training program for tool and/or die makers other than apprenticeship? \_\_\_\_\_ e. Other (specify) \_\_\_\_\_
- \_\_\_\_\_
- f. Were tool and die makers obtained from the local labor market? \_\_\_\_\_
- g. If not, where did they come from? \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Indicate period applicable to question 13. \_\_\_\_\_  
(YEAR)

14. In the event of a future sharp increase in tool and die requirements to meet defense production schedules, would the manpower requirements be met, in general in the same manner as indicated above? (Explain)\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

If not, how would the additional manpower requirements be met? \_\_\_\_\_

\_\_\_\_\_

Notes: (Use this space for completing answers)

\_\_\_\_\_

Remarks: \_\_\_\_\_

\_\_\_\_\_

Field representative: \_\_\_\_\_

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Appendix E: Tables

Table E-1.--Distribution of tool and die makers in the sample, by industry,  
February-March 1951

Industry	Tool and die makers in the sample	
	Number	Percent
All industries.....	1,712	100.0
Fabricated metal products.....	159	9.3
Machinery (except machine tool accessories).....	284	16.5
Machine tool accessories.....	446	26.1
Electrical machinery.....	260	15.2
Motor vehicles.....	358	20.9
Aircraft and parts.....	151	8.8
All other.....	54	3.2

Table E-2.--Number of workers and plants from which sample of tool and die makers  
was taken, by industry, February-March 1951

Industry	Number of plants	Employment in plants of sample		
		Total workers	Total production workers	Total tool and die makers
Total.....	315	649,384	497,348	13,551
Fabricated metal products.	36	18,644	16,270	717
Machinery (except machine tool accessories).....	87	95,533	75,126	1,689
Machine tool accessories..	79	7,598	6,477	1,493
Electrical machinery.....	33	86,165	58,214	1,381
Motor vehicles.....	58	306,397	255,092	5,666
Aircraft and parts.....	15	107,703	65,200	2,387
Railroad equipment.....	3	9,472	6,828	87
Instruments and related products.....	2	2,206	1,210	63
Government installations..	2	15,666	12,931	68



Table E-3.--Age of tool and die makers, by industry, February-March 1951

Age group	All in- dus- tries Total	Industry of employment						
		Fabri- cated metal pro- ducts	Machinery (except machine tool ac- cessories)	Machine tool ac- cessories	Electri- cal ma- chinery	Motor vehicles	Aircraft and parts	All other industries
Percent								
20-24 years.....	.5	.6	.4	.7	1.2	.3	-----	-----
25-29 years.....	7.7	8.2	7.4	10.5	7.3	5.3	5.3	9.3
30-34 years.....	19.0	17.6	16.1	23.3	22.2	13.1	17.9	27.8
35-39 years.....	14.6	18.3	9.5	13.0	19.6	12.3	21.2	16.7
40-44 years.....	10.7	10.7	11.3	10.1	11.9	9.5	11.9	13.0
45-49 years.....	11.3	9.4	7.7	13.0	10.8	11.2	18.5	3.7
50-54 years.....	12.6	12.6	14.8	14.3	10.8	13.1	8.6	3.7
55-59 years.....	11.6	13.2	13.7	8.3	6.5	16.5	10.6	18.5
60-64 years.....	7.1	5.7	11.3	4.3	6.2	10.6	3.3	3.7
65 and over.....	4.9	3.7	7.8	2.5	3.5	8.1	2.7	3.6
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Median age.....	44	43	48	41	40	49	42	39
Total number of workers.....	1,712	159	284	446	260	358	151	54

Table E-4.--Marital and veteran status, and dependents<sup>1/</sup> of tool and die makers,  
February-March 1951

Marital and dependency status	Total tool and die makers	Veteran status	
		Veterans	Nonveterans
All workers.....	1,712	299	1,413
Married.....	1,558	264	1,294
With dependents.....	1,074	219	855
Without dependents.....	484	45	439
Not married.....	154	35	119
With dependents.....	54	11	43
Without dependents.....	100	24	76

<sup>1/</sup> Other than wives.

Table E-5.--Educational level of tool and die makers by method of qualification

Highest school grade completed	Total tool and die makers		Method of qualification			
			Apprenticeship		Other than apprenticeship	
	Number	Percent	Number	Percent	Number	Percent
All educational levels.....	1,712	100.0	1,135	100.0	577	100.0
1 - 4.....	22	1.3	10	.9	12	2.1
5 - 8.....	490	28.6	326	28.7	164	28.4
9 - 12.....	1,088	63.6	726	64.0	362	62.8
Total with some college education...	100	5.8	64	5.6	36	6.2
Education not reported	12	.7	9	.8	3	.5

Table E-6.--Nativity of tool and die makers,  
by city of employment, February-March 1951

City of employment	Total tool and die makers		Nativity			
			Native born		Foreign born	
	Number	Percent	Number	Percent	Number	Percent
All cities.....	1,712	100.0	1,247	72.8	465	27.2
Chicago, Ill.....	319	100.0	222	69.6	97	30.4
Cincinnati, Ohio....	33	100.0	25	75.8	8	24.2
Cleveland, Ohio.....	219	100.0	176	80.4	43	19.6
Detroit, Mich.....	650	100.0	414	63.7	236	36.3
Hartford, Conn.....	127	100.0	106	83.5	21	16.5
Los Angeles, Calif..	160	100.0	135	84.4	25	15.6
Philadelphia, Pa....	204	100.0	169	82.8	35	17.2

Table E-7.--Nativity of tool and die makers, by industry, February-March 1951

Industry	Total tool and die makers		Nativity			
			Native born		Foreign born	
	Number	Percent	Number	Percent	Number	Percent
All industries....	1,712	100.0	1,247	72.8	465	27.2
Fabricated metal products.....	159	100.0	120	75.5	39	24.5
Machinery (except machine tool accessories).....	284	100.0	211	74.3	73	25.7
Machine tool accessories.....	446	100.0	297	66.6	149	33.4
Electrical machinery	260	100.0	204	78.5	56	21.5
Motor vehicles.....	358	100.0	236	65.9	122	34.1
Aircraft and parts..	151	100.0	132	87.4	19	12.6
All other.....	54	100.0	47	87.0	7	13.0



Table E-8.--Members of family who worked in the occupation,  
by age of tool and die makers, February-March 1951

Age group	Total tool and die makers		Members of family in the occupation					No relatives in trade
			Fathers only	Fathers and others	Brothers only	Brothers and relatives other than fathers	Other relatives only	
	Number	Percent						
All age groups...	Percent							
	1,712	100.0	7.2	3.5	11.8	1.2	6.7	69.6
20 - 24.....	9	100.0	11.1	-----	22.2	-----	-----	66.7
25 - 29.....	132	100.0	14.4	5.3	12.1	.8	7.6	59.8
30 - 34.....	325	100.0	11.4	4.0	13.5	.9	4.3	65.9
35 - 39.....	250	100.0	6.4	6.0	9.2	1.2	4.4	72.8
40 - 44.....	184	100.0	10.9	3.3	13.0	1.6	2.7	68.5
45 - 49.....	193	100.0	5.7	1.6	13.5	1.6	6.2	71.4
50 - 54.....	216	100.0	3.2	3.2	10.6	1.9	6.9	74.2
55 - 59.....	199	100.0	4.5	2.5	10.6	.5	10.6	71.3
60 - 64.....	121	100.0	1.7	1.7	14.0	.8	13.2	68.6
65 and over.....	83	100.0	1.2	2.4	7.2	1.2	13.3	74.7

Table E-9.—Years of experience as tool and die makers, by industry, February–March 1951

Industry	Total tool and die makers		Years of experience									Length of experience not reported
	Number	Percent	Less than 5	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40 or more	
All industries.....	1,712	100.0	Percent									.2
			14.7	22.8	15.1	9.2	8.7	9.9	10.0	5.1	4.3	
Fabricated metal products.....	159	100.0	18.2	21.5	19.5	7.5	7.5	6.3	10.1	3.8	5.0	.6
Machinery (except machine tool accessories).....	284	100.0	10.9	22.6	12.0	10.6	7.7	8.5	14.4	5.6	7.7	—
Machine tool accessories.....	446	100.0	14.1	21.8	17.7	9.6	12.1	10.3	7.6	4.9	1.4	.5
Electrical machinery.....	260	100.0	22.7	24.2	14.2	6.5	6.2	8.8	8.1	5.4	3.5	.4
Motor vehicles.....	358	100.0	8.7	14.0	12.6	12.3	9.5	15.8	12.8	7.3	7.0	—
Aircraft and parts.....	151	100.0	19.9	40.4	17.2	6.0	3.3	4.0	6.6	1.3	1.3	—
All other industries.....	54	100.0	16.7	35.1	11.1	5.6	11.1	5.6	7.4	3.7	3.7	—

Table E-10.—Years of experience in the occupation,  
by method of qualification, February-March 1951

Years of experience	Total tool and die makers		Method of qualification			
			Apprenticeship		Other than apprenticeship	
	Number	Percent	Number	Percent	Number	Percent
All experience levels.....	1,712	100.0	1,135	100.0	577	100.0
Less than 5.....	252	14.7	156	13.7	96	16.6
5 - 9.....	388	22.8	197	17.4	191	33.1
10 - 14.....	258	15.1	154	13.6	104	18.0
15 - 19.....	158	9.2	116	10.2	42	7.3
20 - 24.....	149	9.7	106	9.3	43	7.5
25 - 29.....	169	9.9	134	11.8	35	6.1
30 - 34.....	172	10.0	138	12.2	34	5.9
35 - 39.....	88	5.1	69	6.1	19	3.3
40 or more.....	74	4.3	64	5.6	10	1.7
Experience not reported.....	4	.2	1	.1	3	.5

Table E-11.—Work level of tool and die makers,  
by method of qualification, February-March 1951

Work level	Total tool and die makers		Method of qualification			
			Apprenticeship		Other than apprenticeship	
	Number	Percent	Number	Percent	Number	Percent
All work levels..	1,712	100.0	1,135	66.3	577	33.7
Foremen and leadmen.	204	100.0	147	72.1	57	27.9
All other work levels.....	1,508	100.0	988	65.5	520	34.5



Table E-12.--Occupations other than tool  
and die making in which qualified tool  
and die makers worked, 1940-51<sup>1/</sup>

Occupation	Number of jobs held
All occupations.....	209
Machinist or machine repairman.....	52
Machine tool operator.....	13
Lay-out or set up man.....	28
Self-employed.....	3
All other occupations.....	113

<sup>1/</sup> Excludes work history before qualifying as tool and die maker.

Table E-13.--Number of job changes of tool and die makers,  
by nature and time of change, 1940-51

Nature of change	Total job changes 1940-51		Time of change			
			Before June 30, 1945		After June 30, 1945	
	Number	Percent	Number	Percent	Number	Percent
Total.....	2,127	100.0	722	100.0	1,405	100.0
Voluntary.....	1,258	59.2	507	70.2	751	53.4
Involuntary.....	675	31.7	130	18.0	545	38.8
No reason given...	194	9.1	85	11.8	109	7.8

Table E-14.--Number of job changes of tool and die makers,  
by exposure to the labor force 1940-51

Months in the labor force after qualify- ing as tool and die maker	Total tool and die makers	Total job changes, 1940-51	Number of man- years in labor force as a tool and die maker 1/	Average number of changes made per man-year in the labor force
All periods.	1,712	2,127	14,987	.142
0-30 months....	107	35	129	.271
31-60 months...	178	139	691	.201
61-90 months...	171	233	955	.243
91-120 months..	264	494	2,267	.217
121 months and over.....	992	1,226	10,945	.112

1/ Excludes periods before qualifying as tool and die maker.

Table E-15.--Number of tool and die makers changing jobs,  
by city of employment, February-March 1951

Cities	Total tool and die makers	Tool and die makers who made one or more job changes			
	Number	Number	Percent	Number of changes made	Average Number of changes made
All cities.....	1,712	733	42.7	2,127	2.9
Chicago, Ill.....	319	136	42.7	403	3.0
Cincinnati, Ohio.....	33	13	39.4	28	2.2
Cleveland, Ohio.....	219	97	44.3	294	3.0
Detroit, Mich.....	650	268	41.3	764	2.9
Hartford, Conn.....	127	65	51.1	142	2.2
Los Angeles, Calif....	160	85	53.2	310	3.6
Philadelphia, Pa.....	204	69	33.8	186	2.7

Table E-16.--Number of job changes of tool and die makers,  
by marital status at time of change, 1940-51

Marital status at time of change	Number of job changes made by men in specified mari- tal status at time of change	Number of man- years worked during period by men in specified mari- tal status	Job changes per man-year made by men in speci- fied marital status
All tool and die makers.....	2,127	14,987	.1419
Married.....	1,828	12,894	.1417
Not married.....	299	2,093	.1428

Table E-17.--Job changes involving changes in geographic area,  
by marital status at time of change, 1940-51

Marital status	Number of changes	Number of man-years worked during period	Changes per man-year
Total tool and die makers..	250	14,987	.0166
Married.....	201	12,894	.0155
Not married.....	49	2,093	.0234



Table E-18.--Percent distribution of tool and die makers, by city of employment and geographic area of previous employment, February-March 1951

City of employment at time of survey	Total tool and die makers	Geographic areas from which tool and die makers moved											
		Total		New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Other countries
		Number	Percent										
All cities.....	1,712	143	100.0	14.7	9.8	42.6	4.9	2.8	.7	2.8	4.9	11.2	5.6
Chicago, Ill.....	319	23	100.0	4.3	4.3	56.6	8.8	-----	4.3	-----	13.1	4.3	4.3
Cincinnati, Ohio.....	33	1	100.0	-----	-----	-----	-----	-----	-----	-----	100.0	-----	-----
Cleveland, Ohio.....	219	11	100.0	-----	18.2	63.6	-----	9.1	-----	-----	-----	-----	9.1
Detroit, Mich.....	650	32	100.0	3.1	6.3	53.1	3.1	-----	-----	-----	-----	18.8	15.6
Hartford, Conn.....	127	18	100.0	88.8	5.6	-----	-----	-----	-----	-----	-----	5.6	-----
Los Angeles, Calif.....	160	45	100.0	4.4	2.2	51.2	8.9	2.2	-----	8.9	6.7	13.3	2.2
Philadelphia, Pa.....	204	13	100.0	7.7	53.8	7.7	-----	15.4	-----	-----	-----	15.4	-----

# OCCUPATIONAL OUTLOOK PUBLICATIONS OF THE BUREAU OF LABOR STATISTICS

Studies of employment trends and opportunities in the various occupations and professions are made available by the Occupational Outlook Service of the Bureau of Labor Statistics.

These reports are for use in the vocational guidance of veterans, in assisting defense planners, in counseling young people in schools, and in guiding others considering the choice of an occupation. Schools concerned with vocational training and employers and trade unions interested in on-the-job training have also found the reports helpful in planning programs in line with prospective employment opportunities.

Two types of reports are issued, in addition to the Occupational Outlook Handbook: Occupational outlook bulle-

tins describing the long-run outlook for employment in each occupation and giving information on earnings, working conditions, and the training required.

Special reports issued from time to time on such subjects as the general employment outlook, trends in the various States, and occupational mobility.

These reports are issued as bulletins of the Bureau of Labor Statistics. Most of them may be purchased from the Superintendent of Documents, Washington 25, D. C., at the prices listed with a 25-percent discount on 100 copies or more. Those reports which are listed as free may be obtained directly from the United States Department of Labor, Bureau of Labor Statistics, Washington 25, D. C., as long as the supply lasts.

## OCCUPATIONAL OUTLOOK HANDBOOK

Employment Information on Major Occupations for Use in Guidance. Bulletin 998 (1951 revised edition).\$3. Illus.

Includes brief reports on more than 400 occupations of interest in vocational guidance, including professions; skilled trades; clerical, sales, and service occupations; and the major types of farming. Each report describes the employment trends and outlook, the training qualifications required, earnings, and working con-

ditions. Introductory sections summarize the major trends in population and employment and in the broad industrial and occupational groups, as background for an understanding of the individual occupations.

The Handbook is designed for use in counseling, in classes or units on occupations, in the training of counselors, and as a general reference. Its 600 pages are illustrated with 103 photographs and 85 charts.

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\* Out of print. Copies available in many libraries.